

Application No. 10/572,994

DOCKET NO: ARZ-024630-US

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE OF APPLICATION OF: :

NELSON, LLOYD A. ET AL.

SERIAL NO: 10/572,994

THIS APPLICATION IS A US NATIONAL
STAGE APPLICATION OF
PCT/US02/12961:

INTERNATIONAL FILING DATE: APRIL : PRIORITY DATE: APRIL 27, 2001
25, 2002

FOR: POLY BASIC ACID ESTERS AND :
THEIR USE IN FIBRE OPTIC CABLES

RENEWED PETITION UNDER 37 C.F.R. 1.47(a) FOR FILING WHEN INVENTORS

REFUSE TO SIGN OR CAN NOT BE FOUND

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

The DECISION ON PETITION UNDER 37 CFR 1.47(a) dated December 15, 2006 required that we submit: 1) payment of outstanding fees; and 2) supplemental materials to confirm that the inventor Nancy Mosby refuses to execute the declaration herein. Applicants have complied with the Examiner's requirements and request that the filing requirement be considered complete.

Applicants respectfully submit a Renewed Petition regarding inventor Nancy Mosby's refusal to join in the application. Further, Applicants submit the following documents as Exhibits in support of the Renewed Petition.

Exhibit A: A copy of the U S Search.com report for inventor Nancy Mosby.

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Exhibit B: A copy of the April 27, 2007 letter from J. M. Gilbreth to Nancy Mosby.

Exhibit C: A copy of the May 7, 2007 letter from J. M. Gilbreth to Nancy Mosby.

Exhibit D: A copy of the Federal Express tracking confirmation for the April 27, 2007 letter from J. M. Gilbreth to Nancy Mosby.

Exhibit E: A copy of the Federal Express tracking confirmation for the May 7, 2007 letter from J. M. Gilbreth to Nancy Mosby.

Exhibit F: A copy of the May 8, 2007 letter from Nancy Mosby to J. M. Gilbreth.

REMARKS

In order to satisfy the Decision on Petition dated December 15, 2006, the Applicants must submit the following:

(1) payment of the outstanding claims fees in the amount of \$1,410; and

(2) a Renewed Petition containing supplemental materials to confirm that the inventor Nancy Mosby refuses to execute the declaration herein.

Regarding 1), Applicants authorize the Office to Charge the **\$1410.00** in additional claim fees to Deposit Account No. 50-4222. Accordingly, Applicants respectfully submit that requirement 1) is now satisfied; and, respectfully request the Office to indicate the same.

Regarding 2), Applicants respectfully submit a Renewed Petition containing the supplemental material as requested by the Examiner. Accordingly, a Renewed Petition under 37 C.F.R. 1.47(a) follows.

RENEWED PETITION UNDER 37 C.F.R. 1.47(a) FOR FILING WHEN INVENTORS
REFUSE TO SIGN OR CAN NOT BE FOUND

Applicants previously submitted a Petition under 37 C.F.R. 1.47(a) for filing when inventors refuse to sign or can not be found on November 8, 2006 in the above-mentioned application. In response, a Decision on Petition under 37 CFR 1.47(a) dated December 15, 2006 was sent to Applicants. The Examiner stated that before it can be concluded that the inventor refuses to execute the declaration herein, Applicants are required to send a copy of the complete application to the last known address of the inventor, accompanied by a request that the inventor either execute the declaration or expressly confirm her refusal to execute the declaration in this specific application. Applicants have completed the above requirements as requested and the facts surrounding the completion of said requirements are as follows:

- I) In an effort to find inventor Nancy Mosby's most recent address we retained an internet search company, US Search.com. On April 4, 2007, US Search.com sent us a report listing the current address for Nancy D. Mosby (see Exhibit A).
- II) On April 27, 2007 and again on May 7, 2007, I sent copies of the present application and a continuation application to Nancy Mosby at her current address via Federal Express, requesting that she either: 1) execute declarations for each of the above applications; or 2) send me an email or letter confirming her refusal to sign. A copy of the April 27, 2007 letter, Federal Express No. 860444162763 and a copy of the May 7, 2007 letter, Federal Express No. 860444162800 are attached as Exhibits B and C respectively.
- III) On April 30, 2007 Ms. Mosby received the April 27, 2007 letter (see Exhibit D).
- IV) On May 8, 2007 Ms. Mosby received the May 7, 2007 letter (see Exhibit E).

V) On May 8, 2007 I received a letter from Ms. Mosby in response to my April 27, 2007 letter. In her letter, Ms. Mosby attached her April 23, 2002 letter (which was previously submitted in Applicant's November 8, 2006 Petition) and stated her "continued wishes to have nothing to do with the above referenced patent, Arizona Chemical, or anyone associated with Arizona Chemical." She further stated that "to me, the previous letter is crystal clear. I do not understand why this matter was not resolved years ago and consider it to be so now." (see Exhibit F).

VI) Executed declarations have not been obtained from inventor Nancy D. Mosby.

It is further requested that, in light of the above being responsive to Examiner's Decision on Petition dated December 15, 2006, the filing requirement be considered complete and the application proceed to examination.

Please charge the amount of **\$1020.00** required for the request for extension of time to Deposit Account No. 50-4222. In the event any variance exists between the amount enclosed and the Patent Office charges for filing the above-noted documents, including any fees required under 37 C.F.R. 1.136 for any necessary Extension of Time to make the filing of the attached documents timely, please charge or credit the difference to Deposit Account No. 50-4222. Further, if these papers are not considered timely filed, then a petition is hereby made under 37 C.F.R. 1.136 for the necessary extension of time.

If there are any questions concerning any of the above, please feel free to contact the undersigned.

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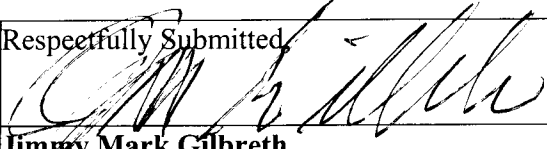

Correspondence Client Number: 67844 (832) 485-3541 (phone) (713) 667-4424 (fax)	Respectfully Submitted 	
	Jimmy Mark Gilbreth	
	Registration No.	33,388
	May 15-2007	

Exhibit A

**A copy of the U.S. Search.com report for inventor
Nancy Mosby.**

From: US Search Result <results@ussearch.com>
To: DEBBIE.SEGERS@COMCAST.NET
Subject: Search Results from USSearch.com
Date: Wednesday, April 04, 2007 3:28:02 PM

Below are your search results. If you are having trouble viewing the report in this email, you may access it through your online account at www.ussearch.com/member or by clicking on the link provided in the confirmation email.


Advanced People Locate.

Search Subject

Search ID Number: 75818153 Full Reported Name: NANCY MOSBY

The following is a history of reported addresses for NANCY MOSBY. In most cases the current address is the first or second reported address, however occasionally it appears elsewhere in the list. When attempting to contact the individual, all addresses should be tried.

Address Summary & Phone Numbers

Search Subject

NANCY MOSBY

Possible Aliases

NANCY DAVIS MOSBY 36
 NANCY LANE MOSBY 36
 NANCY D MOSBY
 NANCY L BARNETT 36
 NANCY LANE DAVIS 36
 NANCY L DAVIS MOSBY 36
 NANCY L MOSBY
 MOSBY NANCY DAVIS 36

Note: In most cases the current address is the first or second reported address, however, occasionally it appears elsewhere in the list. When attempting to contact the individual, all addresses should be tried.

Reported Address	Street Address	CITY	STATE	ZIP	Name on Phone	Phone
1	4115 SWARTHMORE ST	HOUSTON	TX	77005		
2	1619 WILMINGTON ISLAND RD	SAVANNAH	GA	31410		
3	1301 HOWARD WAY	LAWRENCEVILLE	GA	30043		
4	250 LITTLE ST APT A103	ATHENS	GA	30605		
5	PO BOX 2553	SAVANNAH	GA	31402		
6	1619 WILMINGTON	SAVANNAH	GA	31410		
7	406 HAMPTON DR	ATLANTA	GA	30350		
8	11 BENT OAKS CT	SAVANNAH	GA	31404		
9	2031 NORTHERLY WAY	STONE MOUNTAIN	GA	30088		
10	215 CHINA ST APT 310	ATHENS	GA	30605		
11	181 WILKERSON ST APT 3	ATHENS	GA	30601		
12	10914 WESTCHESTER CIR	ATHENS	GA	30606		

13	243 SEAGRAVES DR	ATHENS	GA	30605
14	20 ORCHARD DR	RINCON	GA	31326
National Death Record Search				
No Records Found				

US Search Customer Satisfaction Commitment:

We hope you are satisfied with the results of your Advanced People Locate Search. We also realize that while these results will prove valuable, your search may require additional information. Because your satisfaction is important to us, US Search will extend a credit* of \$30.00 towards our Advanced Searches regarding

*Credit expires in 30 days

\$30.00 Credit towards one of the following services on **"NANCY MOSBY"**

#	Name	Available Services (click on a service below to learn more)	Purchase
1	NANCY MOSBY	<u>Expert Assisted People Locate Search for "NANCY MOSBY"</u> Location specialist performed search, Current address and up to 10 year history and available listed phone numbers, Relatives, Roommates and Neighbors, Bankruptcies, Tax liens, Small Claims Civil Judgments*, Marriage and Divorces*, Real property ownership and value*, Full name and possible aliases	\$59.95 \$29.95 Buy
2	NANCY MOSBY	<u>Expert Assisted Background Search for "NANCY MOSBY"</u> Background Specialist performed search, Current address and up to 10 year history, Available listed phone numbers, On Premise County Courthouse Search, Free Local and National media web-based search	\$99.95 \$69.95 Buy

Other Popular Searches on **NANCY MOSBY**

#	Name	Available Services (click on a service below to learn more)	Purchase
1	NANCY MOSBY	<u>Basic Background Search</u>	Buy
2	NANCY MOSBY	<u>Instant Criminal Records</u>	

Exhibit B

A copy of the April 27, 2007 letter from J.M. Gilbreth to Nancy Mosby.

GILBRETH & ASSOCIATES, P.C.

J. M. (Mark) Gilbreth ^{1 2 4}
Mary A. Gilbreth, Ph.D. ⁴
Deborah G. Segers ^{1 3 4}

Licensed to practice law in ¹TX, ²OK, and ³AR
⁴Registered, United States Patent & Trademark Office

April 27, 2007

Nancy D. Mosby
4115 Swarthmore Street
Houston, Texas 77005

VIA FEDERAL EXPRESS NO. 804 4416 2763

Re: ARZ - 024630-N1 (Application No. 11/637,206, PCT/US02/12961) Polybasic Acid Esters and Their Use in Cables

Dear Ms. Mosby,

Our firm represents Arizona Chemical Company in the above-referenced patent matter. Upon review of the files, it has come to our attention that you did not execute a declaration for these matters. We have enclosed a complete copy of the specification for the application listed above. Please sign the attached declaration, assignment, and power of attorney. Return the executed declarations to us in the Federal Express envelop we have provided for your convenience.

We noted from the files that you previously refused to execute the declarations. If you are still refusing to sign the declarations, please send me an email or sign this letter on the bottom and return in the FEDEX envelope, confirming your continuing refusal to sign the declarations for the above referenced matters.

By Friday, May 4, 2007 please either: (1) send the executed declarations to me or (2) send me an email or letter confirming your refusal to sign.

Thank you for your attention to this matter. If you need further assistance, you can call me at 713/667-1200 or email me at jmark@gilbreth.org.

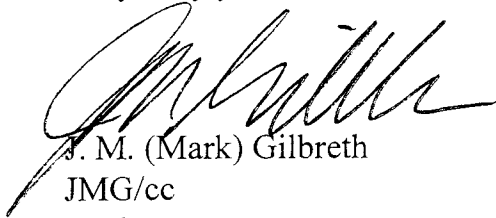
Frost Bank Building, 6750 West Loop South, Suite 920, Bellaire, Texas 77401
Telephone: 713/667-1200, Telecopier: 713/667-4424

GILBRETH & ASSOCIATES, P.C.

April 27, 2007

Page 2

Very truly yours,

A handwritten signature in black ink, appearing to read 'J. M. Gilbreth', written over the typed name.

J. M. (Mark) Gilbreth

JMG/cc

Enclosures



8604 4416 9TH 2763

FROM Please print and press hard.
Date 4-27-07
Sender's FedEx Account Number 963-5247-3

Sender's Name ANK GILLBUSH Phone (713) 400-1100

Company Gilbert & Assoc.

Address 6750 W. Loop. South #920

City Bellair State TX ZIP 77401

2 Your Internal Billing Reference

3 To Recipient's Name Nancy D. Massey Phone ()

Company

Recipient's Address
4115 Sunnymore ST.
We cannot deliver to P.O. boxes or P.O. ZIP codes.

Address

City London State TX ZIP 77005



Staples.com or 1.800.445.6633 or staples.com
 Staples.com, Staples, Staples.com, Staples, Staples, Staples.com

Sender's Copy

4a Express Package Service
Packages up to 150 lbs.

☒ **FedEx Priority Overnight**
Next business morning*
Shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ **FedEx Standard Overnight**
Next business afternoon*
Saturday Delivery NOT available.

☐ **FedEx First Overnight**
Earliest next business morning
delivery to select locations.
Saturday Delivery NOT available.

☐ **FedEx 2Day** Second business day.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery¹ is selected

☐ **FedEx Express Saver** Third business day.* Saturday Delivery NOT available.

4b Express Freight Service

☐ **FedEx 1Day Freight*** Next business day,** Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ **FedEx 2Day Freight** Second business day,** Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ **FedEx 3Day Freight** Third business day,** Saturday Delivery NOT available.

* Call for Confirmation:
5 Packaging **** To most locations**

☐ **FedEx Envelope***

☒ **FedEx Pak***
Includes FedEx Small Pak,
FedEx Large Pak, and FedEx Sturdy Pak

☐ **FedEx Box**

☐ **FedEx Tube**

☐ **Other**

6 Special Handling

☐ **SATURDAY Delivery** ☐ **HOLD Weekday** at FedEx Location ☐ **HOLD Saturday** at FedEx Location

☐ NOT Available for FedEx Standard Overnight, FedEx First Overnight, FedEx Express

☐ Multiple holds may be placed on a single shipment.

Does this shipment contain dangerous goods?

☒ Yes, I have initiated a check call.

☐ No.

Save it, or FedEx 30day Freight.

FedEx First Overnight.

FedEx Priority Overnight and FedEx 2Day to select locations.

☒ No ☐ Yes

☐ As per attached Shipper's Declaration

☐ Shipper's Declaration not required.

☐ Dry Ice

Dry Ice, § UN 1845

kg

7 / Payment Bill to: _____ Enter FedEx Acct No. or Credit Card No. below.

☒ **Sender** Acct. No. in Section I will be billed.
☐ **Recipient**
☐ **Third Party**
☐ **Credit Card**
☐ **Cash/Check**

FedEx Account No. _____ Exp. Date _____
 Credit Card No. _____

Total Packages	Total Weight	Total Declared Value†
1	1.00	\$ 1.00
2	2.00	\$ 2.00
3	3.00	\$ 3.00
4	4.00	\$ 4.00
5	5.00	\$ 5.00
6	6.00	\$ 6.00
7	7.00	\$ 7.00
8	8.00	\$ 8.00
9	9.00	\$ 9.00
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92	92.00	\$ 92.00
93	93.00	\$ 93.00
94	94.00	\$ 94.00
95	95.00	\$ 95.00
96	96.00	\$ 96.00
97	97.00	\$ 97.00
98	98.00	\$ 98.00
99	99.00	\$ 99.00
100	100.00	\$ 100.00

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8 NEW Residential Delivery Signature Options If you require a signature, check Direct or Indirect

☐ No Signature ☒ Direct Signature ☐ Indirect Signature

☐ **Signature Required**
 Package may be left without obtaining a signature

☐ **Direct Signature**
 Anyone at recipient's address may sign for delivery.

☐ **Indirect Signature**
 If no one is available at recipient's address, anyone at a neighboring address may

520

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[illegible]

WHEREAS, We, LLOYD A. NELSON and NANCY D. MOSBY, are the inventors of POLY BASIC ACID ESTERS AND THEIR USE IN FIBRE OPTIC CABLES application, filed as

US Patent Application No. 60/286,880, filed 4/27/2001;
PCT/US02/12961, filed 4/25/2002;
US Patent Application No. 10/572,994, filed 3/23/2006; and
US Patent Application No. 11/637,206, filed 12/11/2006.

WHEREAS, ARIZONA CHEMICAL COMPANY, (herein after "ASSIGNEE"), is desirous of acquiring the entire right, title and interest in and to the aforesaid invention throughout the world, and all right, title and interest in, to and under any and all Letters Patent of the United States and all other countries throughout the world;

NOW, THEREFORE, for and in consideration of the sum of One Dollar (\$1.00) to us in hand paid by ASSIGNEE and for other good and valuable considerations, the receipt of which is hereby acknowledged, we, hereby sell, assign, transfer and set over to ASSIGNEE all right, title and interest in and to the said invention throughout the world, and said application for U.S. Letters Patent, and any and all divisions, continuations, continuations-in-part having subject matter related hereto, and reissues thereof, and any and all Letters Patent of the United States and foreign countries which may be granted therefor, the same to be held and enjoyed by ASSIGNEE for its own use and benefit, and for the use and benefit of its successors, assigns, or other legal representatives, to the end of the term or terms for which said Letters Patent of the United States or foreign countries are or may be granted or reissued, as fully and entirely as the same would have been held and enjoyed by me if this assignment and sale had not been made.

And we hereby authorize and request the Commissioner of Patents and Trademarks to issue any and all Letters Patent of the United States on said invention or resulting from said application and from any and all divisions, continuations, and reissues thereof, to ASSIGNEE as assignee of my entire interest, and hereby covenant that we have the full right to convey the entire interest herein assigned, and that we have not executed and will not execute any agreement in conflict herewith.

And we further hereby covenant and agree that we will, at any time, upon request, execute and deliver any and all papers that may be necessary or desirable to perfect the title of said invention and to such Letters Patent as may be granted therefor, to ASSIGNEE,

INITIALS LAN: _____
INITIALS NDM: _____

its successors, assigns, or other legal representatives and that if ASSIGNEE, its successors, assigns or other legal representatives shall desire to file any divisional or continuation applications or to secure a reissue of such Letters Patent, or to file a disclaimer relating thereto, will upon request, sign all papers, make all rightful oaths and do all lawful acts requisite for the filing of such divisional or continuation application, or such application for reissue and the procuring thereof, and for the filing of such disclaimer, without further compensation but at the expense of said assignee, its successors, or other legal representatives.

And we do further covenant and agree that we will, at any time upon request, communicate to ASSIGNEE, its successors, assigns or other legal representatives, such facts relating to said invention and Letters Patent or the file history thereof as may be known to us, and testify as to the same in any interference or other litigation when requested so to do, without further compensation but at the expense of said assignee, its successors, or other legal representatives.

EXECUTED THIS ____ day of _____, 2007

LLOYD A NELSON

EXECUTED THIS ____ day of _____, 2007.

NANCY D. MOSBY

Docket No.
024630-N1

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Polybasic Acid Esters and Their Use in Cables

the specification of which

☐ is attached hereto.

☒ was filed on 12/11/2006 as United States Application No. or PCT International Application Number 11/637,206 and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Not Claimed
<u>PCT/US02/12961</u>	<u>4/25/2002</u>		<input checked="" type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	
_____	_____	_____	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	
_____	_____	_____	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional

<u>60/286,880</u>	<u>4/27/2001</u>
(Application Serial No.)	(Filing Date)

_____	_____
(Application Serial No.)	(Filing Date)

_____	_____
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

<u>10/572,994</u>	<u>3/23/2006</u>	_____
(Application Serial No.)	(Filing Date)	(Status)
		(patented, pending, abandoned)

_____	_____	_____
(Application Serial No.)	(Filing Date)	(Status)
		(patented, pending, abandoned)

_____	_____	_____
(Application Serial No.)	(Filing Date)	(Status)
		(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

ATTORNEYS ASSOCIATED WITH CUSTOMER

NUMBER 50947

Send Correspondence to: **ADDRESS ASSOCIATED WITH CUSTOMER NUMBER 50947**

Direct Telephone Calls to: *(name and telephone number)*

MARK GILBRETH, 713 667 1200 X 102 OR MARYGILBRETH X 101

Full name of sole or first inventor LLOYD A. NELSON	Date
Sole or first inventor's signature	
Residence 107 TEAKWOOD DRIVE, SAVANNAH, GA 31410	
Citizenship USA	
Post Office Address same as residence	

Full name of second inventor, if any NANCY D. MOSBY	Date
Second inventor's signature	
Residence 4115 SWARTHMORE STREET, HOUSTON, TX 77005	
Citizenship USA	
Post Office Address same as residence	

024630-N1

Continuation Application Checklist
Form CHK011.0106 (rev. 0806)INTERNATIONAL  PAPERCONTINUATION PATENT APPLICATION
(WITH CLAIM TO DOMESTIC PRIORITY)

INSTRUCTIONS: This form should be used for filing new continuation patent applications. This form should not be used for provisional, priority, CIP, divisional or PCT patent applications, nor should this form be used to file an RCE. Check each box to indicate which items on this checklist are included in the filing packet. Once this form is complete, print two (2) hardcopies, attach one (1) copy to the face of the application filing packet file copy and retain one (1) copy for expense tracking purposes.

The following documents MUST be included with EACH new continuation patent application:

- ☒ International Paper Cover Letter signed by: ☐ RCS ☐ DCS ☒ IWB ☐ MME
- ☒ USPS Mail Label No. EQ952203670US
- ☒ Form PTO/SB/05 (Utility Patent Application Transmittal)
- ☒ Application Data Sheet, 2 sheet(s)
- ☒ Written Description (Background, Summary and Detailed Description): 19 sheet(s)
 - ☐ Electronic copy of Written Description saved on CORPLGL drive
 - ☐ Patent Specification is a copy of the Patent Specification that was filed with the parent application
- ☒ Claims: independent claims + dependent claims, arranged on 4 sheets
- ☒ Patent Abstract: 1 sheet(s)
- ☐ Drawings: Figures arranged on sheet(s)
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- ☐ **OPTIONAL/FILED IN PARENT:** Form PTO/SB/22 (Extension of Time) - month(s), sheet(s)
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- ☐ Form PTO/SB/17 (Fee Transmittal)
 - ☐ Authorization to charge Deposit Account in the amount of
- ☐ Form PTO/SB/08 (Information Disclosure Statement), sheet(s), including ☐ Copies of all references
 - ☐ English language references NOT copied in file. ☐ Foreign language references NOT copied in file.
 - ☐ This IDS lists all references that were previously listed on an IDS submitted with the parent application.
- ☐ Signed Inventors Declaration: ☐ New, sheet(s) OR ☐ Copy from parent, sheet(s)
(if a copy from the parent): ☐ Statement provided as to deletion of inventor(s) OR ☐ No statement required
- ☐ Preliminary Amendment, sheet(s)
 - ☐ Claims (after amendment): independent claims + dependent claims, sheets
 - ☐ Specification amended to include cross-reference to related application(s).

Form prepared by Michele L. Wolfer on 12/11/2006 File Ref. ARZ-024630-N1

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Filed on 12/11/2006

Applicant(s): Lloyd A. Nelson

Title: Poly Basic Acid Esters and Their Use in Fibre Optic Cables

Attorney Docket No.: ARZ-024630-N1

USPS Express Mail Label (dated 12/11/2006) No.

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- ☒ Cover Letter, 1 sheet(s);
☒ Utility Patent Appln. Transmittal, Form PTO/SB/05, 1 sheet(s);
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☒ Application Data Sheet, 3 sheet(s);
☒ Patent Specification, 24 sheet(s);
☐ Figures arranged on sheet(s);
☐ Information Disclosure Statement, Form PTO/SB/08, sheet(s);
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11 December 2006

Commissioner for Patents
Post Office Box 1450
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RE: SUBMISSION OF CONTINUATION PATENT APPLICATION

Applicant : Lloyd A. Nelson et al.

Title : Poly Basic Acid Esters and Their Use In Fibre Optic Cables

Our Ref. : ARZ-024630-N1

Continuation of USSN 10/572,994 filed on 03/23/2006 ("Parent Application")

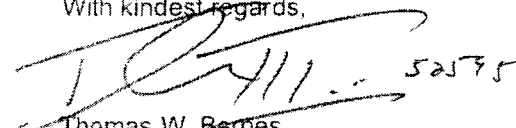
Dear Commissioner:

Enclosed herewith for filing, Applicant(s) respectfully submit(s) the following checked items:

- ☒ Utility Patent Application Transmittal, Form PTO/SB/05, 1 sheet(s);
- ☐ Fee Transmittal, Form PTO/SB/17, _____ sheet(s);
- ☒ Application Data Sheet, 3 sheet(s);
- ☒ Patent Specification, 24 sheet(s);
- ☐ _____ Figures arranged on _____ sheet(s);
- ☐ Information Disclosure Statement, Form PTO/SB/08, _____ sheet(s), and one copy of each reference cited thereon;
- ☐ a copy of the Inventors Declaration(s) filed in connection with the above-referenced Parent Application, _____ sheet(s);
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Please stamp the enclosed postcard and return same to me to indicate your receipt of the above-listed items. Please feel free to contact me if you have any questions concerning the above or the enclosed.

With kindest regards,


Thomas W. Barnes
Agent for Applicant(s)

Enclosures
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UTILITY
PATENT APPLICATION
TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	ARZ-024630-N1
First Inventor	Lloyd A. Nelson
Title	Poly Basic Acid Esters and Their...
Express Mail Label No.	EQ952203670US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☐ Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☐ Applicant claims small entity status.
See 37 CFR 1.27.
3. ☒ Specification [Total Pages 24]
Both the claims and abstract must start on a new page.
(For information on the preferred arrangement, see MPEP 608.01(a))
4. ☐ Drawing(s) (35 U.S.C. 113) [Total Sheets _____]
5. Oath or Declaration [Total Sheets _____]
 - a. ☐ Newly executed (original or copy)
 - b. ☐ A copy from a prior application (37 CFR 1.63(d))
(for continuation/divisional with Box 18 completed)
 - i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s)
name in the prior application, see 37 CFR
1.63(d)(2) and 1.33(b).
6. ☒ Application Data Sheet. See 37 CFR 1.76
7. ☐ CD-ROM or CD-R in duplicate, large table or
Computer Program (Appendix)
☐ Landscape Table on CD
8. Nucleotide and/or Amino Acid Sequence Submission
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 - a. ☐ Computer Readable Form (CRF)
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 - i. ☐ CD-ROM or CD-R (2 copies); or
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ACCOMPANYING APPLICATION PARTS

9. ☐ Assignment Papers (cover sheet & document(s))
Name of Assignee _____
10. ☐ 37 CFR 3.73(b) Statement (when there is an assignee) ☐ Power of Attorney
11. ☐ English Translation Document (if applicable)
12. ☐ Information Disclosure Statement (PTO/SB/05 or PTO-1449)
☐ Copies of citations attached
13. ☐ Preliminary Amendment
14. ☒ Return Receipt Postcard (MPEP 503)
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16. ☐ Nonpublication Request under 35 U.S.C. 122(b)(2)(B)(i).
Applicant must attach form PTO/SB/35 or equivalent.
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18. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76.

☒ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No. 10/572,994

Prior application information: Examiner _____ Art Unit _____

19. CORRESPONDENCE ADDRESS

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Signature		Date	11 December 2006
Name (Print/Type)	Thomas W. Barnes III, Ph.D.	Registration No. (Attorney/Agent)	52,595

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Application Data Sheet

Application Information

Application Type::	Regular
Subject Matter::	Utility
Title::	POLY BASIC ACID ESTERS AND THEIR USE IN FIBRE OPTIC CABLES
Attorney Docket Number::	ARZ-024630-N1
Request for Early Publication?::	No
Request for Non-Publication?::	No
Total Drawing Sheets::	0
Small Entity::	No

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Country of Mailing Address::	US
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Representative Information

Representative Customer Number::	01726
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Domestic Priority Information

Application::	Continuity Type::	Parent Application::	Parent Filing Date::
This application is	Continuation of	10/572,994	03/23/2006
10/572,994	National Stage of	PCT/US02/12961	4/25/2002
PCT/US02/12961	An application claiming the benefit under 35 USC 119(e)	60/286,880	4/27/2001

POLYBASIC ACID ESTERS AND THEIR USE IN CABLES

BACKGROUND OF THE INVENTION

Field of the Invention

This invention generally relates to protecting moisture-sensitive
5 substrates from moisture; to articles such as a fiber optic cable that contain both
a moisture sensitive component and a protectant composition; and to
compositions that may be used to protect substrates from moisture and/or
corrosion.

Description of the Related Art

10 Transmission cables (e.g., service or power wires/cables) as well
as telecommunication devices (e.g., fiber optic cables, telephone cables, terminal
blocks, junctions and connections) are often exposed to harsh environmental
conditions. Yet, both transmission cables and telecommunication devices are
required to maintain uninterrupted mechanical and electrical characteristics
15 despite the surrounding environmental conditions. Historically, transmission
cables have been strung above ground between poles. Increasingly, these
cables are being buried beneath the ground for aesthetic reasons and to protect
them from extremes of temperature, rain, snow, ice, high winds, falling tree limbs
and the like. However, even when placed underground, these cables are subject
20 to many environmental stresses including mechanical shock during back filling,
moisture, the possibility of water immersion, attack from rodents and exposure to
salt and other corrosive materials.

Transmission cables typically contain either a bundle of
individually insulated copper wires, or a bundle of fiber optic cables. The
25 copper wires, in particular, are often protected by an inner metal shield, which
covers the bundle of wires, and an outer sheath made from plastic or other
insulating material. Likewise, a communication cable is generally constructed
of an outer plastic jacket and an inner metal core wrap with an annular space
there between. See, e.g., U.S. Patent No.3,745,321 to Eager, Jr. et al. The
30 core wrap enwraps a plurality of twisted insulated conductors with a filler
material, such as petroleum, wax, or other hydrocarbons, located between the
conductors. The filler material typically functions as an insulator.

Even though wires and cables are normally well protected, if the protective outer sheath is cut or otherwise broken, water can seep into the wire or cable. Whenever moisture is present in the interior of a cable or wire, it tends, over a period of time, to migrate or flow longitudinally into connections at the splice closures, terminals, or the like. In the special case of optical fibers, passage of the water to connection points or terminals and associated equipment will typically result in damage to such equipment, especially to any metal parts thereof, and can also cause problems at low temperature or freezing environments due to fiber microbending. This is particularly true when an immersed wire is cut.

In an inadequately protected device, corrosion of the contacts or short circuits caused by moisture or other outside elements will eventually interrupt service. Replacement or repair of the cables, whether strung above the ground or buried, can be difficult and/or expensive, and the interruption of service may be particularly irritating to the customer. Because of this, much attention has focused on the protection of these cables from both physical damage and from chemical attack. As a result, various techniques have been disclosed to prevent or restrict migration of moisture along the internal passages of a cable.

In one such technique, cable passages may be filled by a pressurized gas. Upon escape of gas through a ruptured cable jacket, an alarm provides notice of cable damage. However, the gas does not prevent the flow of water into and along the cable internal passages before the repair is effected.

U.S. Patent Nos. 4,867,526; 5,082,719; and 5,163,115 disclose a super-absorbent polymer or tape which is impregnated with a superabsorbent material for preventing water migration through cables. It has been found that, for a number of reasons, the production and/or installation of these materials is often impractical and/or uneconomical.

Silicone grease lubricant, elastomeric seals, and/or mastic sealing strips have been used in an attempt to seal out moisture. While these sealants offer some protection, moisture can often seep into the enclosure and cause a short circuit, which will interrupt telecommunications service, particularly when the terminal block is buried underground.

It is also known that insulating materials, such as mineral oil, protect the conductor from moisture and corrosive materials. However, these such insulating materials drip when the cable is being serviced (*i.e.*, cut). To overcome this "dripping" problem, various gelling agents are known to be added

to the insulator, to thereby provide a gelled, non-dripping protectant composition. See, e.g., U.S. Patent Nos. 6,169,160; 6,160,939; and 6,085,009.

Zeolites have recently been suggested as a suitable material to impart moisture-resistance to a cable. See, e.g., US 6,205,276 B1.

5 Hydrophobic fumed silica has been used as a gelling agent, particularly for fiber optic cables. See, e.g., U.S. Patent Nos. 5,905,833; 5,902,849; 5,737,469; 5,285,513; 5,276,757; and 5,187,763; and European Patent EP 0 206 234 B1. The fumed silica, in combination with a suitable fluid, will cause the fluid to become gelled and/or demonstrate thixotropic properties,
10 which is advantageous for a cable protectant composition. Fumed silica is rather expensive, and so suitable fluids that are relatively less expensive have a commercial advantage.

Due to the relatively long lengths of cable that are typically installed, certain cable components are made from plastic components such as
15 polypropylene in an attempt to both reduce the cost of the cable as well as obtain multiple supply sources for such components. This presents a problem to the supplier of protectant compositions in that many known protectant compositions are not compatible with plastics such as polypropylene and can cause deterioration of those materials. Furthermore, although only a fairly small amount
20 of protectant composition is present in a cross-section of cable, because the cables are extremely long, even a small difference in the per pound cost of the protectant composition can have a large commercial advantage in the marketplace, assuming all other performance properties are met.

A need therefore exists for suitable and cost-effective protectant
25 compositions to be used in transmission cables and telecommunication devices. The present invention fulfills these needs and further provides related advantages.

SUMMARY OF THE INVENTION

In one aspect, the present invention provides a composition
30 comprising a blend of first and second esters: the first ester comprises a reaction product of first reactants; the first reactants comprise trimer acid, first polyhydric alcohol and first monohydric alcohol; the first monohydric alcohol is selected from the group of C₈₋₁₈ monohydric alcohols; and the second ester comprises a reaction product of second reactants; the second reactants
35 comprise trimer acid, second polyhydric alcohol and second monohydric

alcohol; the second monohydric alcohol is selected from the group of C₆₋₁₀ monohydric alcohols. The first and second monohydric alcohols are non-identical.

In another aspect, the present invention provides a method for
5 preparing an ester composition having a viscosity in the range of 30-50 cSt (centistokes) at 100°C. The method comprises a) preparing a first ester, the first ester comprising a reaction product of first reactants, the first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol, where the first monohydric alcohol is selected from the group of C₈₋₁₈
10 monohydric alcohols; b) preparing a second ester, the second ester comprising a reaction product of second reactants, the second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol, where the second monohydric alcohol is selected from the group of C₆₋₁₀ monohydric alcohols; and c) blending the first and second esters together in a proportion to
15 provide an ester composition having a viscosity in the range of 30-50 cSt at 100°C; with the proviso that the first and second monohydric alcohols are non-identical.

The present invention also provides a composition prepared by the above-described method.

20 In another aspect, the present invention provides a cable-filling composition comprising silica and a blend of first and second esters. The first ester comprises a reaction product of first reactants, the first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol, where the first monohydric alcohol is selected from the group of C₈₋₁₈
25 monohydric alcohols. The second ester comprises a reaction product of second reactants, the second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol, where the second monohydric alcohol is selected from the group of C₆₋₁₀ monohydric alcohols. The first and second monohydric alcohols are non-identical.

30 In another aspect, the present invention provides a method for insulating the contents of a cable, e.g., a fiber optic cable. The method comprises: a) preparing a cable-filling composition comprising silica and a blend of first and second esters; the first ester comprising a reaction product of first reactants, the first reactants comprising trimer acid, first polyhydric alcohol
35 and first monohydric alcohol, where the first monohydric alcohol is selected from the group of C₈₋₁₈ monohydric alcohols; the second ester comprising a

reaction product of second reactants, the second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol, where the second monohydric alcohol is selected from the group of C₆₋₁₀ monohydric alcohols; the first and second monohydric alcohols being non-identical; and b)
5 placing the cable-filling composition of step a) into a cable, e.g., a fiber optic cable.

The present invention also provides a fiber optic cable comprising a cable-filling composition; the cable-filling composition comprising silica and a blend of first and second esters; the first ester comprising a reaction product of
10 first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol; the first monohydric alcohol selected from the group of C₆₋₁₈ monohydric alcohols; the second ester comprising a reaction product of second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol; the second monohydric alcohol selected from the group of
15 C₆₋₁₀ monohydric alcohols; wherein the first and second monohydric alcohols are non-identical.

These and other aspects of the present invention are described in further detail below.

DETAILED DESCRIPTION OF THE INVENTION

20 In one aspect, the present invention provides a composition comprising a blend of first and second esters, wherein the first ester comprises a reaction product of first reactants comprising trimer acid or a reactive equivalent thereof, first polyhydric alcohol or reactive equivalent thereof and first monohydric alcohol or reactive equivalent thereof; the first monohydric alcohol being selected
25 from the group of C₆₋₁₈ monohydric alcohols or reactive equivalent thereof; the second ester comprises a reaction product of second reactants comprising trimer acid or reactive equivalent thereof, second polyhydric alcohol or reactive equivalent thereof and second monohydric alcohol or reactive equivalent thereof; the second monohydric alcohol being selected from the group of C₆₋₁₀
30 monohydric alcohols. The first and second monohydric alcohols are non-identical. Before further describing these compositions of the present invention, the reactants used to prepare the components thereof will be discussed.

Unsaturated fatty acids, as obtained from, e.g., vegetable oils, tallow, and tall oil (the latter being known as tall oil fatty acids, or TOFA) may be
35 subjected to thermal polymerization, typically in the presence of a clay catalyst,

to provide a product known commercially as polymerized fatty acid. To a large extent, the polymerized fatty acid is the dimerization and trimerization product of the fatty acid. Because these fatty acids typically contain 18 carbons, the corresponding dimerized polymerized fatty acids, also called dimer acid, contains 36 carbon atoms. The corresponding trimerized polymerized fatty acids, also called trimer acid, contains 54 carbon atoms. The dimer and trimer acids are a mixture of complicated isomeric structures. Detailed descriptions of polymerized fatty acid, in terms of product, composition and uses, may be found in, for example, *Naval Stores - Production, Chemistry and Utilization*, D.F. Zinkel and J. Russel (eds.), Pulp. Chem. Assoc. Inc., 1989, Chapter 23 and the Encyclopedia of Chemical Technology II, Vol. 8, pages 847-848. See also, U.S. Patent No.s 2,904,415; and 2,482,761, and Industrial and Engineering Chemistry, 32:802 (1940).

The polymerization of fatty acids typically provides a mixture of dimer acid and trimer acid. These two materials have different boiling points and can be separated from one another by distillation. For instance, dimer can be distilled away from other polymerized fatty acids at a temperature ranging from 250-280°C (at 0.3 to 0.5 mmHg) while trimers may be distilled from other polymerized fatty acids at a temperature ranging from 280-310°C (at 0.005 to 0.01 mmHg). Accordingly, by suitable distillation a mixture of polymerized fatty acids can provide trimer acid in various purities, also known as grades.

For the present specification, the term "trimer acid" will be used to designate a composition containing polymerized carboxylic acid which is at least 20% trimer based on the total weight of the polymerized fatty acid in the composition. Typically, it is difficult to refine trimer acid to a purity of greater than 80%. Accordingly, a preferred trimer acid of the present invention is contained within a mixture of polymerized fatty acids, where the polymerized fatty acids also includes dimer acid, and the weight ratio of dimer acid: trimer acid ranges from 20:80 to 80:20.

A reactive equivalent of trimer acid is a material that may be used in place of trimer acid to provide essentially the same ester product in the esterification reaction of the present invention. Hydrogenated trimer acid is a reactive equivalent of trimer acid. As initially formed, dimer acid and trimer acid typically contain unsaturated polybasic acids. This unsaturation may, to some degree, be eliminated by subjecting the dimer acid/trimer acid to hydrogenation under suitable reaction conditions whereby the unsaturation reacts with

hydrogen and becomes saturated. Trimer acid that has been subjected to a hydrogenation process is commonly referred to as hydrogenated trimer acid, and is well known in the naval stores industry. Hydrogenated trimer acid is typically available from the same commercial suppliers who sell trimer acid and
5 dimer acid. Hydrogenated trimer acid typically has a lighter color than "standard" non-hydrogenated trimer acid, and thus its use in an esterification process provides lighter colored esters. In addition, esters prepared from hydrogenated trimer acid typically display enhanced thermal stability. Accordingly, hydrogenated trimer acid is a preferred trimer acid for use in the
10 present invention.

Another reactive equivalent of trimer acid is a partial or complete esterification product of trimer acid. For example, trimethyl trimerate and triethyl trimerate are esterification products of trimer acid that may be used in the present invention. When employed in the present invention, a trimerate
15 ester of trimer acid will effectively react to provide the same product as is obtained from trimer acid itself. The esterification product will, however, generate methanol or ethanol, or whatever other alcohol was used to esterify the trimer acid. This alcohol is preferably of low molecular weight and/or high volatility so that it can be readily distilled from the reaction mixture during
20 preparation of the composition of the present invention. Another reactive equivalent is the acid halide of trimer acid.

Many companies currently manufacture and sell polymerized fatty acids that include trimer acid according to the present invention. For example, Arizona Chemical (Jacksonville, FL; @arizonachemical.com) sells UNIDYME®
25 40 dimer acid that contains about 35% trimer acid and 65% dimer acid, and UNIDYME® 60 trimer acid that contains about 67% trimer acid and 33% dimer acid. Additional current suppliers of trimer acid and trimer acid-containing polymerized fatty acids include Henkel Corporation, Emery Oleochemicals Division (Cincinnati, OH, with their EMPOL™ line of dimer and trimer acids) and
30 Uniqema North America (Wilmington, DE, with their PRIPOL™ line of dimer and trimer acids).

In one aspect, each of the first reactants and the second reactants further comprise dimer acid. For example, the first reactants and the second reactants each may comprise dimer acid and trimer acid, in a dimer acid:trimer
35 acid weight ratio of 20:80 to 80:20, the weight ratio independently selected in each of the first and second reactants. In one aspect, at least one of the reactants

employs a blend of dimer acid and trimer acid wherein the trimer acid is present at a greater weight percent, *i.e.*, greater than 50 wt%, than the dimer acid.

The polyhydric alcohol, which may also be referred to as a polyol, has two or more hydroxyl groups. Thus, the polyol has of the chemical formula $R^1(OH)_n$ wherein R^1 is an *n*-valent organic group. Optionally, R^1 is a C_2 - C_{20} organic group without hydroxyl substitution, and preferably R^1 is a C_3 - C_{15} organic group. Suitable polyhydric alcohols include, without limitation, ethylene glycol, propylene glycol, neopentyl glycol, butyleneglycol, glycerol, trimethylolpropane, pentaerythritol, tris(hydroxymethyl)methanol, di-pentaerythritol, and tri-pentaerythritol. In one aspect of the invention, the first and second polyhydric alcohols are each independently selected from pentaerythritol, di-pentaerythritol, tri-pentaerythritol, trimethylolpropane, ethylene glycol and neopentyl glycol. In one aspect, at least one of the first and second polyhydric alcohols is neopentyl glycol (CAS No. 126-30-7), also known as 2,2-dimethyl-1,3-propanediol, while in a preferred embodiment the first and second polyhydric alcohols are each neopentyl glycol. Again, a reactive equivalent could be used, *e.g.*, the acetate ester of the polyol.

The monohydric alcohol has a single hydroxyl group. Thus, the monohydric alcohol may be represented by the chemical formula R^2-OH where R^2 is an organic group containing carbons. The identity of the monoalcohol has a very important impact on the viscosity of the ester produced from the monoalcohol in combination with the polyol and trimer acid. In general, as the molecular weight of the monoalcohol increases, the viscosity of the ester derived therefrom increases.

The present invention provides a blend of first and second esters. The first ester is prepared from a first monoalcohol while the second ester is prepared from a second monoalcohol.

The first monoalcohol is a C_{8-18} monohydric alcohol. In other words, the first alcohol is an organic compound having at least 8, and no more than 18, carbon atoms, and a single hydroxyl (OH) group. The first monoalcohol may be represented by the formula R^2-OH , where R^2 is a hydrocarbon having 8-18 carbons. Suitable examples include 1-octanol, 1-decanol, 1-dodecanol (a.k.a. lauryl alcohol), 1-tridecylalcohol, 1-tetradecanol (a.k.a. myristyl alcohol), palmityl alcohol, and stearyl alcohol. The first alcohol may be linear or branched. In one aspect of the invention, the first alcohol is a branched alcohol. A preferred branched alcohol is iso-tridecyl alcohol, available

from ExxonMobil Chemicals as EXXAL™ 13 alcohol. In another aspect, the first monohydric alcohol is selected from C₁₀₋₁₄ primary monohydric alcohols.

The second monoalcohol is a C₆₋₁₀ monohydric alcohol. In other words, the second alcohol is an organic compound having at least 6, and no more than 10, carbon atoms, and a single hydroxyl (OH) group. The second monoalcohol may be represented by the formula R³-OH, where R³ is a hydrocarbon having 6-10 carbons. The second alcohol may be linear, branched, or cyclic. Suitable examples include 1-hexanol, 1-heptanol, 1-octanol, 1-nonanol, 1-decanol, 2-hexanol, 2-heptanol, 2-octanol (a.k.a. capryl alcohol), 2-nonanol, 2-decanol, cyclohexanol, cycloheptanol, and cyclooctanol. In one aspect of the invention, the first alcohol is a branched alcohol. A preferred branched alcohol is 2-ethylhexanol. In another aspect, the second monohydric alcohol is selected from 2-ethylhexanol, 2-octanol and cyclohexyl alcohol.

Both monohydric and polyhydric alcohols useful in the present invention are very well known in the art and may be obtained from many commercial suppliers including, for example, Aldrich (Milwaukee, WI; @aldrich.sial.com); EM Industries, Inc. (Hawthorne, NY; @emscience.com); Lancaster Synthesis, Inc. (Windham, NH; @lancaster.co.uk); and Spectrum Quality Product, Inc. (New Brunswick, NJ; @spectrumchemical.com).

The first ester comprises the reaction product of reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol or reactive equivalents of one or more. This first ester has a low acid number, that is, an acid number of less than 25, preferably less than 20, 15, 10, 5, 2, or 1. It has a viscosity, as measured in centistokes (cSt) that varies depending on the temperature of measurement. At 40°C, the first ester preferably has a viscosity of about 410-510 cSt, more preferably about 430-490 cSt, and still more preferably about 460 cSt. When measured at 100°C, the first ester preferably has a viscosity of about 35-45 cSt, more preferably about 37-43, and still more preferably about 40 cSt. The viscosity index (VI) of the first ester is preferably about 120-150, more preferably about 130-140, and still more preferably about 135.

The second ester comprises the reaction product of reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol or reactive equivalents of one or more. This second ester has a low acid number, that is, an acid number of less than 25, preferably less than 20, 15, 10, 5, 2, or 1. It has a viscosity, as measured in centistokes (cSt) that varies

depending on the temperature of measurement. However, at any temperature below 100°C, the first ester preferably has a greater viscosity than the second ester. At 40°C, the second ester preferably has a viscosity of about 280-380 cSt, more preferably about 300-360 cSt, and still more preferably about 330 cSt.

- 5 When measured at 100°C, the second ester preferably has a viscosity of about 28-38 cSt, more preferably about 30-36, and still more preferably about 33 cSt. The viscosity index (VI) of the second ester is preferably about 125-160, more preferably about 130-150, and still more preferably about 145.

- In a preferred aspect of the present invention, the first monohydric
10 alcohol is selected from the group of C₁₀₋₁₅ primary monohydric alcohols; the second monohydric alcohol is selected from the group consisting of C₈ monohydric alcohols; and the first and second polyhydric alcohols are selected from C₃₋₁₅ polyhydric alcohols.

- In one aspect, the present invention provides a blend of two esters,
15 namely first and second esters, wherein the first ester has a greater viscosity than the second ester. In one aspect, the blend has a viscosity of 30-50 cSt at 100°C, while in another aspect the blend has a viscosity of about 40 cSt at 100°C. In a preferred embodiment, the first monohydric alcohol is selected from the group of C₁₀₋₁₅ primary monohydric alcohols; the second monohydric alcohol
20 is selected from the group consisting of C₈ monohydric alcohols; the first and second polyhydric alcohols are selected from C₃₋₁₅ polyhydric alcohols, and the viscosity of the composition is in the range of 30-50 cSt at 100°C.

- The blend of two esters according to the present invention preferably has a low acid number, that is, an acid number of less than 25,
25 preferably less than 20, 15, 10, 5, 2, or 1. The blend has a viscosity, when measured at 100°C, of 34-46 cSt, preferably about 36-44 cSt, and more preferably about 40 cSt. The blend is readily prepared from component esters by mixing the esters together in single vessel, preferably with some stirring to expeditiously achieve a homogeneous blend.

- 30 An ester of the present invention is readily prepared by combining the reactants, namely trimer acid, polyhydric alcohol and monohydric alcohol or a reactive equivalent of one or more, and heating this mixture until water is evolved. Any order of combination is suitable, and heating rate is not particularly important. The final heating temperature is suitably about 200°C to
35 about 250°C. The progress of the reaction may be monitored by taking

samples and measuring the acid number and molten viscosity of those samples.

Upon heating, water vapor will typically be evolved as the esterification reaction occurs. Preferably, the water vapor is condensed and removed from the reaction mixture as soon as it forms, thus driving the reaction to completion. A Dean-Stark trap is suitably used for this purpose. Alternatively, the water vapor is removed by application of a modest vacuum, e.g., about 20-200 mm.

A catalyst may be used to speed up the rate of the esterification reaction, where suitable catalysts are well known in the art and include sulfuric acid, phosphoric acid and other inorganic acids, metal hydroxides and alkoxides such as tin oxide and titanium isopropoxide, and divalent metal salts such as tin or zinc salts. A preferred catalyst is a tin catalyst, e.g., FASTCAT™ 2001 catalyst. When a catalyst is present, it should be used in small amounts, e.g., less than about 5 weight percent of the total mass of the reaction mixture, preferably less than about 2% and more preferably less than about 1% of the total mass of the reaction mixture. Excessive amounts of catalyst increase the cost of preparing the ester, as well as often leave behind residue that may be harmful to the environment in which the ester is located, e.g., within a cable.

In preparing a preferred cable-protectant composition of the present invention, the blend of first and second esters as described above is combined with fumed silica. The cable-protectant composition provided herein preferably includes a high purity silicon dioxide which may be selected from amorphous silica, crystalline silica, fumed silica, flint, quartz, and combinations thereof. A preferred silicon dioxide is a fumed silica.

Suitable fumed silica is commercially available from a number of sources, including Cabot Corporation (Cabot Corporation, Boston, MA; @.cabot-corp.com; which sells CAB-O-SIL™ fumed silicas), Wacker Silicons Corp (Adrian, MI; @.wacker.com, a division of Wacker-Chemie,) Tulco Inc. (Ayer, MA; @.tulcocorp.com), and Degussa-Hüls AG (Frankfurt am Main, Germany; @.degussa-huels.de; which sells AEROSIL™ fumed silica). Fumed silica is also described in U.S. Patent Nos. 6,193,944; 5,910,295; and 5,902,636. Fumed silica may be prepared by the high-temperature oxidation of a halosilane such as tetrachlorosilane, trichlorosilane, or methyltrichlorosilane.

An antioxidant is an optional component that may be combined with the ester blend and silica to prepare a cable-protectant composition of the

present invention. If present, the antioxidant is used in a small but effective amount which is generally on the order of up to about 2 parts by weight based on the entire weight of the composition. Examples of suitable antioxidants include phenolic-based and phosphite-based antioxidants. Suitable antioxidants are well known in the art, where specific examples include, without limitation, IRGANOX™ 1010, IRGANOX™ 1076, and IRGANOX™ 1035 antioxidants (each from Ciba Specialty Chemicals, Tarrytown, NY or Basel, Switzerland; @cibasc.com) and MARK™ 2112, MARK™ 1500 and MARK™ 5014 antioxidants (each from Witco Corporation, Greenwich, CT; @witco.com)

The fumed silica, in combination with a blend of esters according to the present invention, will form a gelled mixture and/or demonstrate thixotropic properties, which is advantageous for a cable protectant composition. Methods to combine fumed silica with fluids other than the ester-containing compositions of the present invention, to form a cable protectant composition, are well known in the art, and are equally applicable to the formation of cable protectant composition using the ester-containing compositions of the present invention. See U.S. Patent Nos. 5,905,833; 5,902,849; 5,737,469; 5,285,513; 5,276,757; and 5,187,763; and European Patent EP 0 206 234 B1, and references cited therein, for descriptions of these methods.

The following examples are provided for purposes of illustration and are not limiting on the present invention. In the Examples, UNIDYME™ 40 and 60 polymerized fatty acids are blends of dimer and trimer acid available from Arizona Chemical (Jacksonville, FL; @arizonachemical.com).

UNIDYME™ 40 polymerized fatty acid is a distillation product from the polymerization of unsaturated tall oil fatty acids, in the form of a dark viscous liquid (Gardner color 12, viscosity at 210°F of 140 cSt), having a 35% contents of trimer acid (by gas chromatography) and a 65% contents of dimer acid. UNIDYME™ 60 polymerized fatty acid is likewise a distillation product from the polymerization of unsaturated tall oil fatty acids, in the form of a dark very viscous liquid (Gardner color 14) having a 67% trimer acids content and a 33% dimer acids content. UNIDYME™ 60 polymerized fatty acid has an acid number of 192. EXXAL™ 13 iso-tridecyl alcohol is from ExxonMobil Chemical Company (Houston, TX; @exxon.com/exxonchemical). Neopentyl glycol is from Eastman Chemicals (Kingston, TN), FASCAT™ organometallic catalysts, e.g., FASCAT™ 2001 stannous oxalate, are available from Atofina North

America Inc. (Philadelphia, PA; @.elf-atochem.com). HFSC (High Flow Super Cell) is a diatomaceous earth filter aid. The term "AN" refers to acid number, which is synonymous with "acid value" and may be measured by techniques well known in the art. See, e.g., ASTM D 465 (1982). Viscosity measurements are performed according to ASTM D 445 (1996) (Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids). Pour point is determined according to ASTM D 97 (1985) (Pour Point of Petroleum Oils). Flash and Fire Points are measured according to ASTM D 92 (1997) (Standard Test Methods for Flash and Fire Points by Cleveland Open Cup).

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EXAMPLES

EXAMPLE 1

TRIMER ACID, MONOALCOHOL AND 5 WT% NEOPENTYLGLYCOL

15 A 3-liter flask was charged with UNIDYME™ 60 polymerized fatty acids (1000 g, 3.35 eq.), EXXAL™ 13 iso-tridecyl alcohol (568 g, 2.87 eq.) and neopentyl glycol (5.0% based on UNIDYME™ 60 polymerized fatty acids, 50.0 grams, 0.96 eq.). The mixture was heated to 101°C and FASCAT™ 2001 catalyst (0.025% based on UNIDYME™ 60 polymerized fatty acids, 0.25 g) was added. The reaction temperature was increased to a maximum of 220°C and the acid value of the reaction mixture was determined to be 54.9. The reaction mixture was maintained at 220°C for 11½ hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 10 mm to remove any remaining volatile materials from the reaction mixture. The reaction mixture was then cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with an acid value of 1.1, a Gardner color of 14-, a viscosity at 40°C of 516.8 cSt, a viscosity at 100°C of 44.1 cSt, a viscosity index of +138, a pour point of -33°C, a flash point of 580°F, and a fire point of 650°F.

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EXAMPLE 2

TRIMER ACID, MONOALCOHOL AND 3.5 WT% NEOPENTYLGLYCOL

A 5-liter flask was charged with UNIDYME™ 60 polymerized fatty acids (1703 g, 5.7 eq.), EXXAL™ 13 iso-tridecyl alcohol (1357 g, 6.85 eq.), and neopentyl glycol (5% based on UNIDYME™ 60 polymerized fatty acids, 59.6 g, 1.15 eq.). The mixture was heated to 107°C and FASCAT™ 2001 catalyst

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(0.025% based on UNIDYME™ 60 polymerized fatty acids, 0.43 g) was added. The reaction temperature was increased to a maximum of 220°C and the acid value of the reaction mixture was determined to be 40.7. The reaction mixture was maintained at 220°C for 5½ hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 1 mm to remove any remaining volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with an acid value of less than 2.0 and a viscosity at 40°C of 367cSt.

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EXAMPLE 3

TRIMER ACID, MONOALCOHOL AND 2.5 WT% NEOPENTYLGLYCOL

A 3-liter flask was charged with UNIDYME™ 60 polymerized fatty acids (1054 g, 3.53 eq.), EXXAL™ 13 iso-tridecyl alcohol (598.7 g, 3.02 eq.) and neopentyl glycol (2.5% based on UNIDYME™ 60 polymerized fatty acids, 26.4 g, 0.51 eq.). The mixture was heated to 117°C and FASCAT™ 2001 catalyst (0.05% based on UNIDYME™ 60 polymerized fatty acids, 0.51 g) was added. The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined be 30.4. The reaction mixture was maintained at 220°C for 11 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to remove any remaining volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with a viscosity at 40°C of 365.9 cSt, a viscosity at 100°C of 33.7, a viscosity index of 132, a specific gravity of 0.909 and a Gardner color of 14+.

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EXAMPLE 4

BLEACHED TRIMER ACID, MONOALCOHOL AND 5 WT% NEOPENTYLGLYCOL

A 3-liter flask was charged with UNIDYME™ 60 polymerized fatty acids (600 g, 2.0 eq.) that had been previously bleached with palladium catalyst, EXXAL™ iso-tridecyl alcohol (316 g, 1.6 eq.) and neopentyl glycol (5.0% based on UNIDYME™ 60 polymerized fatty acids, 30 g, 0.58 eq.). The mixture was heated to 113°C and FASCAT™ 2001 catalyst (0.025% based on UNIDYME™ 60 polymerized fatty acids, 0.15 g) was added. The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined to

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be 38.6. The reaction mixture was maintained at 220°C for 9½ hours at which point vacuum was applied (to 1 mm) to remove any remaining volatile materials. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with a viscosity at 40°C of 554 cSt, an acid value of 2.4, a Gardner color of 8-, a pour point of -33°C, a flash point of 565°F and a fire point of 655°F.

EXAMPLE 5

DIMER/TRIMER ACID, MONOALCOHOL AND 5% NEOPENTYLGLYCOL

10 A 3-liter flask was charged with UNIDYME™ 40 polymerized fatty acids (1041 g, 3.53 eq.), EXXAL™ iso-tridecyl alcohol (601 g, 3.04 eq.) and neopentyl glycol (5% based on UNIDYME™ 40 polymerized fatty acids, 52.1 g, 1.0 eq.). The mixture was heated to 113°C and FASCAT™ 2001 catalyst (0.025% based on UNIDYME™ 40 polymerized fatty acids, 0.26 g) was added.

15 The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined to be 63.6. The reaction mixture was maintained at 220°C for 13 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 1 mm to remove any remaining volatile materials from the reaction mixture. The reaction

20 mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with a viscosity at 40°C of 462 cSt, a viscosity of 100°C of 40.5 cSt, a viscosity index of 135, a Gardner color of 13+, an acid value of 0.6, a % moisture of 0.06, a pour point of -30°C, a flash point of 580°F, a fire point of 660°F and a specific gravity of 0.914.

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EXAMPLE 6

DIMER/TRIMER ACID, MONOALCOHOL AND 25% NEOPENTYLGLYCOL

A 3-liter flask was charged with UNIDYME™ 40 polymerized fatty acids (1037 g, 3.52 eq.), EXXAL™ 13 iso-tridecyl alcohol (716.8 g, 3.62 eq.) and neopentyl glycol (2.5% based on UNIDYME™ 40 polymerized fatty acids, 25.9 g, 0.5 eq.). The mixture was heated to 101°C and FASCAT™ 2001 catalyst (0.05% based on UNIDYME™ 40 polymerized fatty acids, 0.52 g) was added. The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined to be 42.1. The reaction mixture was

30 maintained at 220°C for 11 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 2 mm to

remove any remaining volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with a viscosity at 40°C of 368.2 cSt, a viscosity of 100°C of 33.7 cSt, a viscosity index of 135, a pour point of -30°C, a
5 flash point of 580°F, and a fire point of 670°F.

EXAMPLE 7

UNIDYME 40, 2-ETHYLHEXANOL AND 5% NEOPENTYLGLYCOL

A 3-liter flask was charged with UNIDYME™ 40 polymerized fatty
10 acids (886 g, 3 eq.), 2-ethylhexanol (335 g, 2.58 eq.), and neopentyl glycol (5.0% based on UNIDYME™ 40 polymerized fatty acids, 44.3 g, 0.85 eq.). The mixture was heated to 110°C and FASCAT™ 2001 catalyst (0.025 % based on UNIDYME™ 40 polymerized fatty acids, 0.22 g) was added. The reaction
15 temperature was increased to 220°C and the acid value of the reaction mixture was determined to be 63.9. The reaction mixture was maintained at 220°C for 7 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 10 mm to remove any remaining
volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to
20 give a product with a viscosity at 40°C of 333.9 cSt, a viscosity of 100°C of 33.7 cSt, a viscosity index of 143, an acid value of 2.3, a Gardner color of 15, a pour point of -39°C, a flash point of 590°F, and a fire point of 665°F.

EXAMPLE 8

UNIDYME 40, 2-ETHYLHEXANOL AND 5% NEOPENTYLGLYCOL

A 5-liter flask was charged with UNIDYME™ 40 polymerized fatty
acids (1933 g, 6.55 eq.), 2-ethylhexanol (732 g, 5.6 eq.), and neopentyl glycol (5% based on UNIDYME™ 40 polymerized fatty acids, 96.7 g, 1.9 eq.). The
mixture was heated to 110°C and FASCAT™ 2001 catalyst (0.025 % based on
30 UNIDYME™ 40 polymerized fatty acids, 0.48 g) was added. The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined to be 45.5. The reaction mixture was maintained at 220°C for 6 hours and vacuum was slowly applied to the mixture to maintain reflux when
necessary. The vacuum was then lowered to 1 mm to remove any remaining
35 volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to

give a product with a viscosity at 40°C of 321.5 cSt, an acid value of 2.1, and a Gardner color of ca. 13.

EXAMPLE 9

5 UNIDYME 40, 2-ETHYLHEXANOL AND 10% NEOPENTYLGLYCOL

A 3-liter flask was charged with UNIDYME™ 40 polymerized fatty acids (1163 g, 3.94 eq.), 2-ethylhexanol (265 g, 2.04 eq.) and neopentyl glycol (10% based on UNIDYME™ 40 polymerized fatty acids, 116.3 g, 2.24 eq.). The mixture was heated to 111°C and FASCAT™ 2001 catalyst (0.025% based on
10 UNIDYME™ 40 polymerized fatty acids, 0.29 g) was added. The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined to be 47.7. The reaction mixture was maintained at 220°C for 12 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 2 mm to remove any remaining
15 volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with a viscosity at 40°C of 1520 cSt.

EXAMPLE 10

20 ESTER BLEND

The ester from Example 2 (75% by weight) was combined with the ester from Example 1 (25% by weight) to give an ester blend with the following characteristics: an acid value of 1.3, a viscosity at 40°C of 403.6 cSt, a viscosity at 100°C of 36.3 cSt, a viscosity index of 134, a hydroxyl number of
25 10.2, a flash point of 555°F, a fire point of 650°F, a pour point of -33°C, a Gardner color of 13-, and an iodine value of 10.4.

EXAMPLE 11

ESTER BLENDS

30 Three blends were prepared as identified in the Table below. The viscosity of each blend was also determined.

Wt % Ester of Example 7	Wt % Ester of Example 5	Viscosity at 40°C (cSt)
80	20	351.7
60	40	377.0
40	60	403.0

EXAMPLE 12

ESTER BLEND

5 The ester from Example 8 (40% by weight) and the ester from Example 5 (60% by weight) were combined to give a final product with a viscosity at 40°C of 399 cSt, a viscosity at 100°C of 37.2 cSt, a viscosity index of 138, an acid value of 1.3, a Gardner color of 13, a flash point of 580°F, a fire point of 670°F and a pour point of -33°C.

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EXAMPLE 13

 A blend was prepared from the ester of Example 8 (80% by weight) and the ester of Example 5 (20% by weight). The final product had a viscosity at 40°C of 349 cSt, a viscosity at 100°C of 34.5 cSt, a viscosity index of 142, an acid value of 1.7, a Gardner color of 13, a flash point of 580°F, a fire point of 675°F, and a pour point of -33°C.

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EXAMPLE 14

ESTER-POLYPROPYLENE COMPATIBILITY

20 The compatibility of ester blends of the present invention with polypropylene was determined by measuring the extent to which ester absorbed into polypropylene when the two materials were maintained in contact for several weeks. More specifically, samples of polypropylene extruded strips having dimensions 0.7 mm thickness and 20 mm width were weighed (each strip weight approximately 3 grams). A known weight of esters, in the range of 30 grams, was added to an aluminum pan of dimensions 63.5 mm x 17.5 mm. An individual strip of polypropylene was placed in the aluminum pan with the esters, and the pan was covered with aluminum foil. The sample was maintained at 80°C for a predetermined period.

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First Ester	Second Ester	% Wt Gain Wk 1	% Wt Gain Wk 2	% Wt Gain Wk 4
80% Example 7	20% Example 5	4.95	5.06	4.93
60% Example 7	40% Example 5	4.23	4.88	4.88
40% Example 7	60% Example 5	4.56	5.09	4.90

For comparison, when the same procedure was followed using poly-alpha olefins instead of esters, the % Wt Gain values were 4.59 (1 week), 5.43 (2 weeks) and 5.94 (4 weeks).

5 All publications and patent applications mentioned in this specification are herein incorporated by reference to the same extent as if each individual publication or patent application was specifically and individually incorporated by reference.

10 From the foregoing it will be appreciated that, although specific embodiments of the invention have been described herein for purposes of illustration, various modifications may be made without deviating from the spirit and scope of the invention. Accordingly, the invention is not limited except as by the appended claims.

CLAIMS

1. A composition comprising a blend of first and second esters,
the first ester comprising a reaction product of first reactants comprising trimer acid or reactive equivalent thereof, first polyhydric alcohol or reactive equivalent thereof, and first monohydric alcohol or reactive equivalent thereof; the first monohydric alcohol being selected from the group of C₆₋₁₈ monohydric alcohols or reactive equivalents thereof;
the second ester comprising a reaction product of second reactants comprising trimer acid or reactive equivalent thereof, second polyhydric alcohol or reactive equivalent thereof, and second monohydric alcohol or reactive equivalent thereof; the second monohydric alcohol being selected from the group of C₆₋₁₀ monohydric alcohols or reactive equivalents thereof;
the first and second monohydric alcohols being non-identical.
2. The composition of claim 1 wherein the first reactants and the second reactants each further comprise dimer acid.
3. The composition of claim 2 wherein the first reactants and the second reactants each comprise dimer acid and trimer acid, in a dimer acid:trimer acid weight ratio of 20:80 to 80:20, the weight ratio independently selected in each of the first and second reactants.
4. The composition of any of claims 1-3 wherein the trimer acid is hydrogenated trimer acid.
5. The composition of any of claims 1-4 wherein the first monohydric alcohol is selected from C₁₀₋₁₄ primary monohydric alcohols.
6. The composition of any of claims 1-5 wherein the first monohydric alcohol is *iso*-tridecyl alcohol.
7. The composition of any of claims 1-6 wherein the first and second polyhydric alcohols are each selected from C₃₋₁₅ polyhydric alcohols.

8. The composition of any of claims 1-6 wherein the first and second polyhydric alcohols are each independently selected from pentaerythritol, di-pentaerythritol, tri-pentaerythritol, trimethylolpropane, ethylene glycol and neopentyl glycol.
9. The composition of any of claims 1-6 wherein the first and second polyhydric alcohols are each neopentyl glycol.
10. The composition of any of claims 1-6 wherein the second monohydric alcohol is selected from 2-ethylhexanol, 2-octanol and cyclohexyl alcohol.
11. The composition of any of claims 1-6 wherein the second monohydric alcohol is 2-ethylhexanol.
12. The composition of any of claims 1-11 wherein the first ester has a greater viscosity than the second ester.
13. The composition of any of claims 1-12 having a viscosity of 30-50 cSt at 100°C.
14. The composition of any of claims 1-13 having a viscosity of about 40 cSt at 100°C.
15. The composition of claim 1 wherein the first monohydric alcohol is selected from the group of C₁₀₋₁₅ primary monohydric alcohols; the second monohydric alcohol is selected from the group consisting of C₈ monohydric alcohols; the first and second polyhydric alcohols are selected from C₃₋₁₅ polyhydric alcohols, and the viscosity of the composition is in the range of 30-50 cSt at 100°C.
16. A method for preparing an ester composition having a viscosity in the range of 30-50 cSt at 100°C, the method comprising the steps of:
- a) preparing a first ester, the first ester comprising a reaction product of first reactants comprising trimer acid, first polyhydric alcohol and first

monohydric alcohol; the first monohydric alcohol selected from the group of C₆₋₁₈ monohydric alcohols;

b) preparing a second ester, the second ester comprising a reaction product of second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol; the second monohydric alcohol selected from the group of C₆₋₁₀ monohydric alcohols; and

c) blending the first and second esters together in a proportion to provide an ester composition having a viscosity in the range of 30-50 cSt at 100°C;

with the proviso that the first and second monohydric alcohols are non-identical.

17. The method of claim 16 wherein the first reactants and the second reactants each further comprise dimer acid, in a dimer acid:trimer acid weight ratio of 20:80 to 80:20, the weight ratio independently selected in each of the first and second reactants.

18. The method of any of claims 16-17 wherein the trimer acid is hydrogenated trimer acid.

19. The method of any of claims 16-18 wherein the first monohydric alcohol is selected from C₁₀₋₁₄ primary monohydric alcohols.

20. The method of any of claims 16-19 wherein the first and second polyhydric alcohols are each selected from C₃₋₁₅ polyhydric alcohols.

21. The method of any of claims 16-20 wherein the second monohydric alcohol is selected from 2-ethylhexanol, 2-octanol and cyclohexyl alcohol.

22. The method of any of claims 16-21 wherein the first ester has a greater viscosity than the second ester.

23. The method of claim 16 wherein the first monohydric alcohol is selected from the group of C₁₀₋₁₅ primary monohydric alcohols; the second monohydric alcohol is selected from the group consisting of C₆

monohydric alcohols; the first and second polyhydric alcohols are selected from C₃₋₁₅ polyhydric alcohols; and the first ester has a greater viscosity than the second ester.

24. A composition prepared by the method of any of claims 16-23.

25. A cable-filling composition comprising silica and a blend of first and second esters,

the first ester comprising a reaction product of first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol; the first monohydric alcohol selected from the group of C₈₋₁₈ monohydric alcohols;

the second ester comprising a reaction product of second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol; the second monohydric alcohol selected from the group of C₆₋₁₀ monohydric alcohols;

the first and second monohydric alcohols being non-identical.

26. The composition of claim 25 wherein the first monohydric alcohol is selected from the group of C₁₀₋₁₅ primary monohydric alcohols; the second monohydric alcohol is selected from the group consisting of C₈ monohydric alcohols; the first and second polyhydric alcohols are selected from C₃₋₁₅ polyhydric alcohols, and the viscosity of the blend is in the range of 30-50 cSt at 100°C.

27. A method for insulating the contents of a cable, the method comprising

a) preparing a cable-filling composition comprising silica and a blend of first and second esters; the first ester comprising a reaction product of first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol; the first monohydric alcohol selected from the group of C₈₋₁₈ monohydric alcohols; the second ester comprising a reaction product of second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol; the second monohydric alcohol selected from the group of C₆₋₁₀ monohydric alcohols; the first and second monohydric alcohols being non-identical;

b) placing the cable-filling composition of step a) into a fiber optic cable.

28. The method of claim 27 wherein the cable is a fiber optic cable.

29. A cable comprising a cable-filling composition; the cable-filling composition comprising silica and a blend of first and second esters; the first ester comprising a reaction product of first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol; the first monohydric alcohol selected from the group of C₈₋₁₈ monohydric alcohols; the second ester comprising a reaction product of second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol; the second monohydric alcohol selected from the group of C₆₋₁₀ monohydric alcohols; wherein the first and second monohydric alcohols are non-identical.

30. The cable of claim 29 wherein the cable is a fiber optic cable.

Exhibit C

A copy of the May 7, 2007 letter from J.M. Gilbreth to Nancy Mosby.

GILBRETH & ASSOCIATES, P.C.

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May 7, 2007

Nancy D. Mosby
4115 Swarthmore Street
Houston, Texas 77005

VIA FEDERAL EXPRESS NO. 860444162800

Re: ARZ - 024630-US (Application No. 10/572,994, PCT/US02/12961) Polybasic Acid Esters and Their Use in Cables

Dear Ms. Mosby,

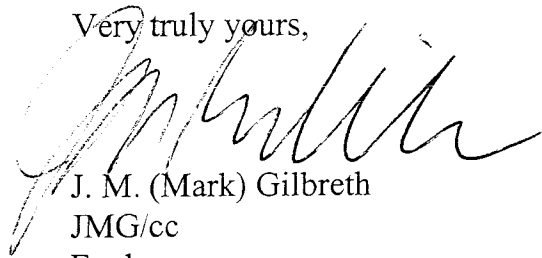
Our firm represents Arizona Chemical Company in the above-referenced patent matter. Upon review of the files, it has come to our attention that you did not execute a declaration for this matter. We have enclosed a complete copy of the specification for the application listed above. Please sign the attached declaration and power of attorney. Return the executed declaration and power of attorney to us in the Federal Express envelop we have provided for your convenience.

We noted from the files that you previously refused to execute a declaration. If you are still refusing to sign the declaration, please send me an email or sign this letter on the bottom and return in the FEDEX envelope, confirming your continuing refusal to sign the declaration for the above referenced matter.

By Monday, May 14, 2007 please either: (1) send the executed declaration to me or (2) send me an email or letter confirming your refusal to sign.

Thank you for your attention to this matter. If you need further assistance, you can call me at 713/667-1200 or email me at jmark@gilbreth.org.

Very truly yours,



J. M. (Mark) Gilbreth
JMG/cc
Enclosures

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520



Docket No.

024630

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

POLYBASIC ACID ESTERS AND THEIR USE IN CABLES

the specification of which
(check one)

☐ is attached hereto.

☒ was filed on 03/23/2006 as United States Application No. or PCT International
Application Number 10/572,994
and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/>
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/>
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/>

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

60/286,889

04/27/2001

(Application Serial No.)

(Filing Date)

(Application Serial No.)

(Filing Date)

(Application Serial No.)

(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

PCT/US02/12961

04/25/2002

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

**ATTORNEYS ASSOCIATED WITH CUSTOMER
NUMBER 50947**

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Direct Telephone Calls to: *(name and telephone number)*
J. M. (MARK) GILBRETH, 713/667-1200 X102

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Sole or first inventor's signature	
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Full name of second inventor, if any NANCY D. MOSBY	Date
Second inventor's signature	MAY, 2007
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Citizenship USA	
Post Office Address SAME AS RESIDENCE	

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(WO/2002/088208) POLYBASIC ACID ESTERS AND THEIR USE IN CABLES

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Priority Data: 60/286,880 27.04.2001 US

Title: POLYBASIC ACID ESTERS AND THEIR USE IN CABLES

Abstract: A composition comprising a blend of first and second esters: the first ester comprising a reaction product of first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol; the first monohydric alcohol selected from the group of C8-18 monohydric alcohols; the second ester comprising a reaction product of second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol; the second monohydric alcohol selected from the group of C6-10 monohydric alcohols; the first and second monohydric alcohols being non-identical. This blend of esters, in combination with silica, is useful as a sealant composition, e.g., as a cable-protectant composition.

Designated States: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.
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**(WO/2002/088208) POLYBASIC ACID ESTERS AND THEIR USE IN CABLES**[Biblio. Data](#) [Description](#) [Claims](#) [National Phase](#) [Notices](#) [Documents](#)

POLYBASIC ACID ESTERS AND THEIR USE IN CABLES BACKGROUND OF THE INVENTION Field of the Invention This invention generally relates to protecting moisture-sensitive substrates from moisture; to articles such as a fiber optic cable that contain both a moisture sensitive component and a protectant composition; and to compositions that may be used to protect substrates from moisture and/or corrosion.

Description of the Related Art Transmission cables (e. g., service or power wires/cables) as well as telecommunication devices (e. g., fiber optic cables, telephone cables, terminal blocks, junctions and connections) are often exposed to harsh environmental conditions. Yet, both transmission cables and telecommunication devices are required to maintain uninterrupted mechanical and electrical characteristics despite the surrounding environmental conditions. Historically, transmission cables have been strung above ground between poles. Increasingly, these cables are being buried beneath the ground for aesthetic reasons and to protect them from extremes of temperature, rain, snow, ice, high winds, falling tree limbs and the like. However, even when placed underground, these cables are subject to many environmental stresses including mechanical shock during back filling, moisture, the possibility of water immersion, attack from rodents and exposure to salt and other corrosive materials.

Transmission cables typically contain either a bundle of individually insulated copper wires, or a bundle of fiber optic cables. The copper wires, in particular, are often protected by an inner metal shield, which covers the bundle of wires, and an outer sheath made from plastic or other insulating material. Likewise, a communication cable is generally constructed of an outer plastic jacket and an inner metal core wrap with an annular space there between. See, e. g., U. S. Patent No. 3,745,321 to Eager, Jr. et al. The core wrap enwraps a plurality of twisted insulated conductors with a filler material, such as petroleum, wax, or other hydrocarbons, located between the conductors. The filler material typically functions as an insulator.

Even though wires and cables are normally well protected, if the protective outer sheath is cut or otherwise broken, water can seep into the wire or cable. Whenever moisture is present in the interior of a cable or wire, it tends, over a period of time, to migrate or flow longitudinally into connections at the splice closures, terminals, or the like. In the special case of optical fibers, passage of the water to connection points or terminals and associated equipment will typically result in damage to such equipment, especially to any metal parts thereof, and can also cause problems at low temperature or freezing environments due to fiber microbending. This is particularly true when an immersed wire is cut.

In an inadequately protected device, corrosion of the contacts or short circuits caused by moisture or other outside elements will eventually interrupt service. Replacement or repair of the cables, whether strung above the ground or buried, can be difficult and/or expensive, and the interruption of service may be particularly irritating to the customer. Because of this, much attention has focused on the protection of these cables from both physical damage and from chemical attack. As a result, various techniques have been disclosed to prevent or restrict migration of moisture along the internal passages of a cable.

In one such technique, cable passages may be filled by a pressurized gas. Upon escape of gas through a ruptured cable jacket, an alarm provides notice of cable damage. However, the gas does not prevent the flow of water into and along the cable internal passages before the repair is effected.

U. S. Patent Nos. 4,867,526; 5,082,719; and 5,163,115 disclose a super-absorbent polymer or tape which is impregnated with a superabsorbent material for preventing water migration through cables. It has been found that, for a number of reasons, the production and/or installation of these materials is often impractical and/or uneconomical.

Silicone grease lubricant, elastomeric seals, and/or mastic sealing strips have been used in an attempt to seal out moisture. While these sealants offer some protection, moisture can often seep into the enclosure and cause a short circuit, which will interrupt telecommunications service, particularly when the terminal block is buried underground.

It is also known that insulating materials, such as mineral oil, protect the conductor from moisture and corrosive materials. However, these such insulating materials drip when the cable is being serviced (i. e., cut). To overcome this "dripping" problem, various gelling agents are known to be added to the insulator, to thereby provide a gelled, non-dripping protectant composition. See, e. g., U. S. Patent Nos. 6,169,160; 6,160,939; and 6,085,009.

Zeolites have recently been suggested as a suitable material to impart moisture-resistance to a cable. See, e. g., US 6,205,276 B1.

Hydrophobic fumed silica has been used as a gelling agent, particularly for fiber optic cables. See, e. g., U. S. Patent Nos. 5,905,833; 5,902,849; 5,737,469; 5,285,513; 5,276,757; and 5,187,763; and European Patent EP 0 206 234 B1. The fumed silica, in combination with a suitable fluid, will cause the fluid to become gelled and/or demonstrate thixotropic properties, which is advantageous for a cable protectant composition. Fumed silica is rather expensive, and so suitable fluids that are relatively less expensive have a commercial advantage.

Due to the relatively long lengths of cable that are typically installed, certain cable components are made from plastic components such as polypropylene in an attempt to both reduce the cost of the cable as well as obtain multiple supply sources for such components. This presents a problem to the supplier of protectant compositions in that many known protectant compositions are not compatible with plastics such as polypropylene and can cause deterioration of those materials. Furthermore, although only a fairly small amount of protectant composition is present in a cross-section of cable, because the cables are extremely long, even a small difference in the per pound cost of the protectant composition can have a large commercial advantage in the marketplace, assuming all other performance properties are met.

A need therefore exists for suitable and cost-effective protectant compositions to be used in transmission cables and telecommunication devices. The present invention fulfills these needs and further provides related advantages.

SUMMARY OF THE INVENTION In one aspect, the present invention provides a composition comprising a blend of first and second esters: the first ester comprises a reaction product of first reactants; the first reactants comprise trimer acid, first polyhydric alcohol and first monohydric alcohol; the first monohydric alcohol is selected from the group of C8-18 monohydric alcohols; and the second ester comprises a reaction product of second reactants; the second reactants comprise trimer acid, second polyhydric alcohol and second monohydric alcohol; the second monohydric alcohol is selected from the group of C610 monohydric alcohols. The first and second monohydric alcohols are non-identical.

In another aspect, the present invention provides a method for preparing an ester composition having a viscosity in the range of 30-50 cSt (centistokes) at 100°C. The method comprises a) preparing a first ester, the first ester comprising a reaction product of first reactants, the first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol, where the first monohydric alcohol is selected from the group of C8-18 monohydric alcohols; b) preparing a second ester, the second ester comprising a reaction product of second reactants, the second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol, where the second monohydric alcohol is selected from the group of C610 monohydric alcohols; and c) blending the first and second esters together in a proportion to provide an ester composition having a viscosity in the range of 30-50 cSt at 100°C; with the proviso that the first and second monohydric alcohols are non- identical.

The present invention also provides a composition prepared by the above-described method.

In another aspect, the present invention provides a cable-filling composition comprising silica and a blend of first and second esters. The first ester comprises a reaction product of first reactants, the first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol, where the first monohydric alcohol is selected from the group of C81a monohydric alcohols. The second ester comprises a reaction product of second reactants, the second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol, where the second monohydric alcohol is selected from the group of C610 monohydric alcohols.

The first and second monohydric alcohols are non-identical.

In another aspect, the present invention provides a method for insulating the contents of a cable, e. g., a fiber optic cable. The method comprises: a) preparing a cable-filling composition comprising silica and a blend of first and second esters; the first ester comprising a reaction product of first reactants, the first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol, where the first monohydric alcohol is selected from the group of C8-18 monohydric alcohols; the second ester comprising a reaction product of second reactants, the second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol, where the second monohydric alcohol is selected from the group of C610 monohydric alcohols; the first and second monohydric alcohols being non-identical; and b) placing the cable-filling composition of step a) into a cable, e. g., a fiber optic cable.

The present invention also provides a fiber optic cable comprising a cable-filling composition: the cable-filling composition comprising silica and a blend of first and second esters: the first ester comprising a reaction product of first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol; the first monohydric alcohol selected from the group of C₈-18 monohydric alcohols; the second ester comprising a reaction product of second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol; the second monohydric alcohol selected from the group of C₆-10 monohydric alcohols; wherein the first and second monohydric alcohols are non-identical.

These and other aspects of the present invention are described in further detail below.

DETAILED DESCRIPTION OF THE INVENTION In one aspect, the present invention provides a composition comprising a blend of first and second esters, wherein the first ester comprises a reaction product of first reactants comprising trimer acid or a reactive equivalent thereof, first polyhydric alcohol or reactive equivalent thereof and first monohydric alcohol or reactive equivalent thereof; the first monohydric alcohol being selected from the group of C₈-18 monohydric alcohols or reactive equivalent thereof; the second ester comprises a reaction product of second reactants comprising trimer acid or reactive equivalent thereof, second polyhydric alcohol or reactive equivalent thereof and second monohydric alcohol or reactive equivalent thereof; the second monohydric alcohol being selected from the group of C₆-10 monohydric alcohols. The first and second monohydric alcohols are non-identical. Before further describing these compositions of the present invention, the reactants used to prepare the components thereof will be discussed.

Unsaturated fatty acids, as obtained from, e. g., vegetable oils, tallow, and tall oil (the latter being known as tall oil fatty acids, or TOFA) may be subjected to thermal polymerization, typically in the presence of a clay catalyst, to provide a product known commercially as polymerized fatty acid. To a large extent, the polymerized fatty acid is the dimerization and trimerization product of the fatty acid. Because these fatty acids typically contain 18 carbons, the corresponding dimerized polymerized fatty acids, also called dimer acid, contains 36 carbon atoms. The corresponding trimerized polymerized fatty acids, also called trimer acid, contains 54 carbon atoms. The dimer and trimer acids are a mixture of complicated isomeric structures. Detailed descriptions of polymerized fatty acid, in terms of product, composition and uses, may be found in, for example, Naval Stores-Production, Chemistry and Utilization, D. F.

Zinkel and J. Russel (eds.), Pulp. Chem. Assoc. Inc., 1989, Chapter 23 and the Encyclopedia of Chemical Technology II, Vol. 8, pages 847-848. See also, U. S.

Patent No. s 2,904,415; and 2,482,761, and Industrial and Engineering Chemistry, 32: 802 (1940).

The polymerization of fatty acids typically provides a mixture of dimer acid and trimer acid. These two materials have different boiling points and can be separated from one another by distillation. For instance, dimer can be distilled away from other polymerized fatty acids at a temperature ranging from 250-280°C (at 0.3 to 0.5 mmHg) while trimers may be distilled from other polymerized fatty acids at a temperature ranging from 280-310°C (at 0.005 to 0.01 mmHg). Accordingly, by suitable distillation a mixture of polymerized fatty acids can provide trimer acid in various purities, also known as grades.

For the present specification, the term "trimer acid" will be used to designate a composition containing polymerized carboxylic acid which is at least 20% trimer based on the total weight of the polymerized fatty acid in the composition. Typically, it is difficult to refine trimer acid to a purity of greater than 80%. Accordingly, a preferred trimer acid of the present invention is contained within a mixture of polymerized fatty acids, where the polymerized fatty acids also includes dimer acid, and the weight ratio of dimer acid: trimer acid ranges from 20: 80 to 80: 20.

A reactive equivalent of trimer acid is a material that may be used in place of trimer acid to provide essentially the same ester product in the esterification reaction of the present invention. Hydrogenated trimer acid is a reactive equivalent of trimer acid. As initially formed, dimer acid and trimer acid typically contain unsaturated polybasic acids. This unsaturation may, to some degree, be eliminated by subjecting the dimer acid/trimer acid to hydrogenation under suitable reaction conditions whereby the unsaturation reacts with hydrogen and becomes saturated. Trimer acid that has been subjected to a hydrogenation process is commonly referred to as hydrogenated trimer acid, and is well known in the naval stores industry. Hydrogenated trimer acid is typically available from the same commercial suppliers who sell trimer acid and dimer acid. Hydrogenated trimer acid typically has a lighter color than "standard" non-hydrogenated trimer acid, and thus its use in an esterification process provides lighter colored esters. In addition, esters prepared from hydrogenated trimer acid typically display enhanced thermal stability.

Accordingly, hydrogenated trimer acid is a preferred trimer acid for use in the present invention.

Another reactive equivalent of trimer acid is a partial or complete esterification product of trimer acid. For example, trimethyl trimerate and triethyl trimerate are esterification products of trimer acid that may be used in the present

invention. When employed in the present invention, a trimerate ester of trimer acid will effectively react to provide the same product as is obtained from trimer acid itself. The esterification product will, however, generate methanol or ethanol, or whatever other alcohol was used to esterify the trimer acid. This alcohol is preferably of low molecular weight and/or high volatility so that it can be readily distilled from the reaction mixture during preparation of the composition of the present invention. Another reactive equivalent is the acid halide of trimer acid.

Many companies currently manufacture and sell polymerized fatty acids that include trimer acid according to the present invention. For example, Arizona Chemical (Jacksonville, FL; @arizonachemical.com) sells UNIDYMEX 40 dimer acid that contains about 35% trimer acid and 65% dimer acid, and UNIDYMEX 60 trimer acid that contains about 67% trimer acid and 33% dimer acid. Additional current suppliers of trimer acid and trimer acid-containing polymerized fatty acids include Henkel Corporation, Emery Oleochemicals Division (Cincinnati, OH, with their EMPOLTM line of dimer and trimer acids) and Uniqema North America (Wilmington, DE, with their PRIPOLTM line of dimer and trimer acids).

In one aspect, each of the first reactants and the second reactants further comprise dimer acid. For example, the first reactants and the second reactants each may comprise dimer acid and trimer acid, in a dimer acid: trimer acid weight ratio of 20: 80 to 80: 20, the weight ratio independently selected in each of the first and second reactants. In one aspect, at least one of the reactants employs a blend of dimer acid and trimer acid wherein the trimer acid is present at a greater weight percent, i. e., greater than 50 wt%, than the dimer acid.

The polyhydric alcohol, which may also be referred to as a polyol, has two or more hydroxyl groups. Thus, the polyol has of the chemical formula $R(OH)_n$ wherein R is an n-valent organic group. Optionally, R1 is a C2-C20 organic group without hydroxyl substitution, and preferably R1 is a Cs-Cis organic group. Suitable polyhydric alcohols include, without limitation, ethylene glycol, propylene glycol, neopentyl glycol, butyleneglycol, glycerol, trimethylolpropane, pentaerythritol, tris (hydroxymethyl) methanol, di- pentaerythritol, and tri-pentaerythritol. In one aspect of the invention, the first and second polyhydric alcohols are each independently selected from pentaerythritol, di-pentaerythritol, tri-pentaerythritol, trimethylolpropane, ethylene glycol and neopentyl glycol. In one aspect, at least one of the first and second polyhydric alcohols is neopentyl glycol (CAS No. 126-30-7), also known as 2,2-dimethyl-1, 3-propanediol, while in a preferred embodiment the first and second polyhydric alcohols are each neopentyl glycol. Again, a reactive equivalent could be used, e. g., the acetate ester of the polyol.

The monohydric alcohol has a single hydroxyl group. Thus, the monohydric alcohol may be represented by the chemical formula R_2-OH where R_2 is an organic group containing carbons. The identity of the monoalcohol has a very important impact on the viscosity of the ester produced from the monoalcohol in combination with the polyol and trimer acid. In general, as the molecular weight of the monoalcohol increases, the viscosity of the ester derived therefrom increases.

The present invention provides a blend of first and second esters.

The first ester is prepared from a first monoalcohol while the second ester is prepared from a second monoalcohol.

The first monoalcohol is a C8-18 monohydric alcohol. In other words, the first alcohol is an organic compound having at least 8, and no more than 18, carbon atoms, and a single hydroxyl (OH) group. The first monoalcohol may be represented by the formula $R-OH$, where R is a hydrocarbon having 8-18 carbons. Suitable examples include 1-octanol, 1-decanol, 1-dodecanol (a. k. a. lauryl alcohol), 1-tridecylalcohol, 1-tetradecanol (a. k. a. myristyl alcohol), palmityl alcohol, and stearyl alcohol. The first alcohol may be linear or branched. In one aspect of the invention, the first alcohol is a branched alcohol. A preferred branched alcohol is iso-tridecyl alcohol, available from ExxonMobil Chemicals as EXXALTM 13 alcohol. In another aspect, the first monohydric alcohol is selected from C1014 primary monohydric alcohols.

The second monoalcohol is a C610 monohydric alcohol. In other words, the second alcohol is an organic compound having at least 6, and no more than 10, carbon atoms, and a single hydroxyl (OH) group. The second monoalcohol may be represented by the formula R_3-OH , where R_3 is a hydrocarbon having 6-10 carbons. The second alcohol may be linear, branched, or cyclic. Suitable examples include 1-hexanol, 1-heptanol, 1-octanol, 1-nonanol, 1-decanol, 2-hexanol, 2-heptanol, 2-octanol (a. k. a. capryl alcohol), 2-nonanol, 2-decanol, cyclohexanol, cycloheptanol, and cyclooctanol. In one aspect of the invention, the first alcohol is a branched alcohol. A preferred branched alcohol is 2-ethylhexanol. In another aspect, the second monohydric alcohol is selected from 2-ethylhexanol, 2-octanol and cyclohexyl alcohol.

Both monohydric and polyhydric alcohols useful in the present invention are very well known in the art and may be obtained from many commercial suppliers including, for example, Aldrich (Milwaukee, WI; @aldrich.sial.com); EM Industries, Inc. (Hawthorne, NY; @emscience.com); Lancaster Synthesis, Inc. (Windham, NH; lancaster.co.uk); and Spectrum Quality Product, Inc. (New Brunswick, NJ; @spectrumchemical.com).

The first ester comprises the reaction product of reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol or reactive equivalents of one or more. This first ester has a low acid number, that is, an acid number of less than 25, preferably less than 20, 15, 10, 5, 2, or 1. It has a viscosity, as measured in centistokes (cSt) that varies depending on the temperature of measurement. At 40°C, the first ester preferably has a viscosity of about 410-510 cSt, more preferably about 430-490 cSt, and still more preferably about 460 cSt. When measured at 100°C, the first ester preferably has a viscosity of about 35-45 cSt, more preferably about 37-43, and still more preferably about 40 cSt. The viscosity index (VI) of the first ester is preferably about 120-150, more preferably about 130-140, and still more preferably about 135.

The second ester comprises the reaction product of reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol or reactive equivalents of one or more. This second ester has a low acid number, that is, an acid number of less than 25, preferably less than 20, 15, 10, 5, 2, or 1. It has a viscosity, as measured in centistokes (cSt) that varies depending on the temperature of measurement. However, at any temperature below 100°C, the first ester preferably has a greater viscosity than the second ester. At 40°C, the second ester preferably has a viscosity of about 280-380 cSt, more preferably about 300-360 cSt, and still more preferably about 330 cSt.

When measured at 100°C, the second ester preferably has a viscosity of about 28-38 cSt, more preferably about 30-36, and still more preferably about 33 cSt.

The viscosity index (VI) of the second ester is preferably about 125-160, more preferably about 130-150, and still more preferably about 145.

In a preferred aspect of the present invention, the first monohydric alcohol is selected from the group of C1015 primary monohydric alcohols; the second monohydric alcohol is selected from the group consisting of C8 monohydric alcohols; and the first and second polyhydric alcohols are selected from C315 polyhydric alcohols.

In one aspect, the present invention provides a blend of two esters, namely first and second esters, wherein the first ester has a greater viscosity than the second ester. In one aspect, the blend has a viscosity of 30-50 cSt at 100°C, while in another aspect the blend has a viscosity of about 40 cSt at 100°C. In a preferred embodiment, the first monohydric alcohol is selected from the group of C1-15 primary monohydric alcohols; the second monohydric alcohol is selected from the group consisting of C8 monohydric alcohols; the first and second polyhydric alcohols are selected from 3-15 polyhydric alcohols, and the viscosity of the composition is in the range of 30-50 cSt at 100°C.

The blend of two esters according to the present invention preferably has a low acid number, that is, an acid number of less than 25, preferably less than 20, 15, 10, 5, 2, or 1. The blend has a viscosity, when measured at 100°C, of 34-46 cSt, preferably about 36-44 cSt, and more preferably about 40 cSt. The blend is readily prepared from component esters by mixing the esters together in single vessel, preferably with some stirring to expeditiously achieve a homogeneous blend.

An ester of the present invention is readily prepared by combining the reactants, namely trimer acid, polyhydric alcohol and monohydric alcohol or a reactive equivalent of one or more, and heating this mixture until water is evolved. Any order of combination is suitable, and heating rate is not particularly important. The final heating temperature is suitably about 200°C to about 250°C. The progress of the reaction may be monitored by taking samples and measuring the acid number and molten viscosity of those samples.

Upon heating, water vapor will typically be evolved as the esterification reaction occurs. Preferably, the water vapor is condensed and removed from the reaction mixture as soon as it forms, thus driving the reaction to completion. A Dean-Stark trap is suitably used for this purpose. Alternatively, the water vapor is removed by application of a modest vacuum, e. g., about 20- 200 mm.

A catalyst may be used to speed up the rate of the esterification reaction, where suitable catalysts are well known in the art and include sulfuric acid, phosphoric acid and other inorganic acids, metal hydroxides and alkoxide such as tin oxide and titanium isopropoxide, and divalent metal salts such as tin or zinc salts. A preferred catalyst is a tin catalyst, e. g., FASTCAT 2001 catalyst. When a catalyst is present, it should be used in small amounts, e. g., less than about 5 weight percent of the total mass of the reaction mixture, preferably less than about 2% and more preferably less than about 1% of the total mass of the reaction mixture. Excessive amounts of catalyst increase the cost of preparing the ester, as well as often leave behind residue that may be harmful to the environment in which the ester is located, e. g., within a cable.

In preparing a preferred cable-protectant composition of the present invention, the blend of first and second esters as described above is combined with fumed silica. The cable-protectant composition provided herein preferably includes a high purity silicon dioxide which may be selected from amorphous silica, crystalline silica, fumed silica, flint, quartz, and combinations thereof. A preferred silicon dioxide is a fumed silica.

Suitable fumed silica is commercially available from a number of sources, including Cabot Corporation (Cabot Corporation, Boston, MA; @. cabot-corp. com; which sells CAB-O-SIL™ fumed silicas), Wacker Silicons Corp (Adrian, MI; @. wacker. com, a division of Wacker-Chemie), Tulco Inc.

(Ayer, MA; @. tulcocorp. com), and Degussa-Huls AG (Frankfurt am Main, Germany; @. degussa-huels. de; which sells AEROSIL fumed silica). Fumed silica is also described in U. S. Patent Nos. 6,193,944; 5,910,295; and 5,902,636. Fumed silica may be prepared by the high-temperature oxidation of a halosilane such as tetrachlorosilane, trichlorosilane, or methyltrichlorosilane.

An antioxidant is an optional component that may be combined with the ester blend and silica to prepare a cable-protectant composition of the present invention. If present, the antioxidant is used in a small but effective amount which is generally on the order of up to about 2 parts by weight based on the entire weight of the composition. Examples of suitable antioxidants include phenolic-based and phosphite-based antioxidants. Suitable antioxidants are well known in the art, where specific examples include, without limitation, IRGANOX 1010, IRGANOX 1076, and IRGANOX 1035 antioxidants (each from Ciba Specialty Chemicals, Tarrytown, NY or Basel, Switzerland; @. cibasc. com) and MARK 2112, MARK 1500 and MARK™ 5014 antioxidants (each from Witco Corporation, Greenwich, CT; @. witco. com). The fumed silica, in combination with a blend of esters according to the present invention, will form a gelled mixture and/or demonstrate thixotropic properties, which is advantageous for a cable protectant composition. Methods to combine fumed silica with fluids other than the ester-containing compositions of the present invention, to form a cable protectant composition, are well known in the art, and are equally applicable to the formation of cable protectant composition using the ester-containing compositions of the present invention. See U. S. Patent Nos. 5,905,833; 5,902,849; 5,737,469; 5,285,513; 5,276,757; and 5,187,763; and European Patent EP 0 206 234 B1, and references cited therein, for descriptions of these methods.

The following examples are provided for purposes of illustration and are not limiting on the present invention. In the Examples, UNIDYMET 40 and 60 polymerized fatty acids are blends of dimer and trimer acid available from Arizona Chemical (Jacksonville, FL; @. arizonachemical. com).

UNIDYME 40 polymerized fatty acid is a distillation product from the polymerization of unsaturated tall oil fatty acids, in the form of a dark viscous liquid (Gardner color 12, viscosity at 210°F of 140 cSt), having a 35% contents of trimer acid (by gas chromatography) and a 65% contents of dimer acid.

UNIDYMET™ 60 polymerized fatty acid is likewise a distillation product from the polymerization of unsaturated tall oil fatty acids, in the form of a dark very viscous liquid (Gardner color 14) having a 67% trimer acids content and a 33% dimer acids content. UNIDYMET™ 60 polymerized fatty acid has an acid number of 192. EXXALTM 13 iso-tridecyl alcohol is from ExxonMobil Chemical Company (Houston, TX; @. exxon. com/exxonchemical). Neopentyl glycol is from Eastman Chemicals (Kingston, TN), FASCAT organometallic catalysts, e. g., FASCATT™ 2001 stannous oxalate, are available from Atofina North America Inc. (Philadelphia, PA; @. elf-atotech. com). HFSC (High Flow Super Cell) is a diatomaceous earth filter aid. The term "AN" refers to acid number, which is synonymous with "acid value" and may be measured by techniques well known in the art. See, e. g., ASTM D 465 (1982). Viscosity measurements are performed according to ASTM D 445 (1996) (Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids). Pour point is determined according to ASTM D 97 (1985) (Pour Point of Petroleum Oils).

Flash and Fire Points are measured according to ASTM D 92 (1997) (Standard Test Methods for Flash and Fire Points by Cleveland Open Cup).

EXAMPLES
EXAMPLE 1 TRIMERACID, MONOALCOHOL AND 5 WT% NEOPENTYLGLYCOL A 3-liter flask was charged with UNIDYMET™ 60 polymerized fatty acids (1000 g, 3.35 eq.), EXXALTM 13 iso-tridecyl alcohol (568 g, 2.87 eq.) and neopentyl glycol (5.0% based on UNIDYMET™ 60 polymerized fatty acids, 50.0 grams, 0.96 eq.). The mixture was heated to 101 °C and FASCATT™ 2001 catalyst (0.025% based on UNIDYMET™ 60 polymerized fatty acids, 0.25 g) was added. The reaction temperature was increased to a maximum of 220 °C and the acid value of the reaction mixture was determined to be 54.9. The reaction mixture was maintained at 220 °C for 11 1/2 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 10 mm to remove any remaining volatile materials from the reaction mixture. The reaction mixture was then cooled to 130 °C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with an acid value of 1.1, a Gardner color of 14-, a viscosity at 40 °C of 516.8 cSt, a viscosity at 100 °C of 44.1 cSt, a viscosity index of +138, a pour point of -33 °C, a flash point of 580 °F, and a fire point of 650 °F.

EXAMPLE 2 TRIMERACID, MONOALCOHOL AND 3.5 WT% NEOPENTYLGLYCOL A 5-liter flask was charged with UNIDYMET™ 60 polymerized fatty acids (1703 g, 5.7 eq.), EXXALTM 13 iso-tridecyl alcohol (1357 g, 6.85 eq.), and neopentyl glycol (5% based on UNIDYMET™ 60 polymerized fatty acids, 59.6 g, 1.15 eq.). The mixture was heated to 107 °C and FASCATT™ 2001 catalyst (0.025% based on UNIDYMET™ 60 polymerized fatty acids, 0.43 g) was added.

The reaction temperature was increased to a maximum of 220°C and the acid value of the reaction mixture was determined to be 40.7. The reaction mixture was maintained at 220°C for 51/2 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 1 mm to remove any remaining volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with an acid value of less than 2.0 and a viscosity at 40°C of 367cSt.

EXAMPLE 3 TRIMERACID, MONOALCOHOLAND 2.5 WT% NEOPENTYLGLYCOL A 3-liter flask was charged with UNIDYMETM 60 polymerized fatty acids (1054 g, 3.53 eq.), EXXALTM 13 iso-tridecyl alcohol (598.7 g, 3.02 eq.) and neopentyl glycol (2.5% based on UNIDYME 60 polymerized fatty acids, 26.4 g, 0.51 eq.). The mixture was heated to 117°C and FASCATTM 2001 catalyst (0.05% based on UNIDYME Tm 60 polymerized fatty acids, 0.51 g) was added. The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined to be 30.4. The reaction mixture was maintained at 220°C for 11 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to remove any remaining volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with a viscosity at 40°C of 365.9 cSt, a viscosity at 100°C of 33.7, a viscosity index of 132, a specific gravity of 0.909 and a Gardner color of 14+.

EXAMPLE 4 BLEACHED TRIMERACID, MONOALCOHOLAND 5 WT% NEOPENTYLGLYCOL A 3-liter flask was charged with UNIDYMETM 60 polymerized fatty acids (600 g, 2.0 eq.) that had been previously bleached with palladium catalyst, EXXALTM iso-tridecyl alcohol (316 g, 1.6 eq.) and neopentyl glycol (5.0% based on UNIDYMETM 60 polymerized fatty acids, 30 g, 0.58 eq.). The mixture was heated to 113°C and FASCATTM 2001 catalyst (0.025% based on UNIDYMETM 60 polymerized fatty acids, 0.15 g) was added. The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined to be 38.6. The reaction mixture was maintained at 220°C for 91/2 hours at which point vacuum was applied (to 1 mm) to remove any remaining volatile materials.

The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with a viscosity at 40°C of 554 cSt, an acid value of 2.4, a Gardner color of 8-, a pour point of -33°C, a flash point of 565°F and a fire point of 655°F.

EXAMPLE 5 DIMER/TRIMERACID, MONOALCOHOLAND 5% NEOPENTYLGLYCOL A 3-liter flask was charged with UNIDYMETM 40 polymerized fatty acids (1041 g, 3.53 eq.), EXXALTM iso-tridecyl alcohol (601 g, 3.04 eq.) and neopentyl glycol (5% based on UNIDYME 40 polymerized fatty acids, 52.1 g, 1.0 eq.). The mixture was heated to 113°C and FASCATTM 2001 catalyst (0.025% based on UNIDYMET 40 polymerized fatty acids, 0.26 g) was added.

The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined to be 63.6. The reaction mixture was maintained at 220°C for 13 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 1 mm to remove any remaining volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with a viscosity at 40°C of 462 cSt, a viscosity of 100°C of 40.5 cSt, a viscosity index of 135, a Gardner color of 13+, an acid value of 0.6, a % moisture of 0.06, a pour point of -30°C, a flash point of 580°F, a fire point of 660°F and a specific gravity of 0.914.

EXAMPLE 6 DIMER/TRIMERACID, MONOALCOHOLAND 25% NEOPENTYLGLYCOL A 3-liter flask was charged with UNIDYMETM 40 polymerized fatty acids (1037 g, 3.52 eq.), EXXALTM 13 iso-tridecyl alcohol (716.8 g, 3.62 eq.) and neopentyl glycol (2.5% based on UNIDYMEw 40 polymerized fatty acids, 25.9 g, 0.5 eq.). The mixture was heated to 101°C and FASCATTM 2001 catalyst (0.05% based on UNIDYME 40 polymerized fatty acids, 0.52 g) was added. The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined to be 42.1. The reaction mixture was maintained at 220°C for 11 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 2 mm to remove any remaining volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with a viscosity at 40°C of 368.2 cSt, a viscosity of 100°C of 33.7 cSt, a viscosity index of 135, a pour point of -30°C, a flash point of 580°F, and a fire point of 670°F.

EXAMPLE 7 UNIDYME 40,2-ETHYLHEXANOLAND 5% NEOPENTYLGLYCOL A 3-liter flask was charged with UNIDYMETM 40 polymerized fatty acids (886 g, 3 eq.), 2-ethylhexanol (335 g, 2.58 eq.), and neopentyl glycol (5.0% based on UNIDYMETM 40 polymerized fatty acids, 44.3 g, 0.85 eq.). The mixture was heated to 110°C and FASCATTM 2001 catalyst (0.025 % based on UNIDYME 40 polymerized fatty acids, 0.22 g) was added. The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined to be 63.9. The reaction mixture was maintained at 220°C for 7 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 10 mm to remove any remaining volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with a viscosity at 40°C of 333.9 cSt, a viscosity of 100°C of 33.7 cSt, a viscosity index of 143, an acid value of 2.3, a Gardner color of 15, a pour point of -39°C, a flash point of 590°F, and a fire point of 665°F.

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EXAMPLE 8 UNIDYME 40, 2-ETHYLHEXANOL AND 5% NEOPENTYLGLYCOL A 5-liter flask was charged with UNIDYMETM 40 polymerized fatty acids (1933 g, 6.55 eq.), 2-ethylhexanol (732 g, 5.6 eq.), and neopentyl glycol (5% based on UNIDYMETM 40 polymerized fatty acids, 96.7 g, 1.9 eq.). The mixture was heated to 110°C and FASCATTM 2001 catalyst (0.025 % based on UNIDYMETM 40 polymerized fatty acids, 0.48 g) was added. The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined to be 45.5. The reaction mixture was maintained at 220°C for 6 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 1 mm to remove any remaining volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with a viscosity at 40°C of 321.5 cSt, an acid value of 2.1, and a Gardner color of ca. 13.

EXAMPLE 9 UNIDYME 40, 2-ETHYLHEXANOL AND 10% NEOPENTYLGLYCOL A 3-liter flask was charged with UNIDYMETM 40 polymerized fatty acids (1163 g, 3.94 eq.), 2-ethylhexanol (265 g, 2.04 eq.) and neopentyl glycol (10% based on UNIDYMETM 40 polymerized fatty acids, 116.3 g, 2.24 eq.). The mixture was heated to 111 °C and FASCATTM 2001 catalyst (0.025% based on UNIDYME 40 polymerized fatty acids, 0.29 g) was added. The reaction temperature was increased to 220°C and the acid value of the reaction mixture was determined to be 47.7. The reaction mixture was maintained at 220°C for 12 hours and vacuum was slowly applied to the mixture to maintain reflux when necessary. The vacuum was then lowered to 2 mm to remove any remaining volatile materials from the reaction mixture. The reaction mixture was cooled to 130°C and filtered through HFSC using Whatman #1 paper (under vacuum) to give a product with a viscosity at 40°C of 1520 cSt.

EXAMPLE 10 ESTER BLEND The ester from Example 2 (75% by weight) was combined with the ester from Example 1 (25% by weight) to give an ester blend with the following characteristics: an acid value of 1.3, a viscosity at 40°C of 403.6 cSt, a viscosity at 100°C of 36.3 cSt, a viscosity index of 134, a hydroxyl number of 10.2, a flash point of 555°F, a fire point of 650°F, a pour point of -33°C, a Gardner color of 13-, and an iodine value of 10.4.

EXAMPLE 11 ESTER BLENDS Three blends were prepared as identified in the Table below. The viscosity of each blend was also determined. Wt % Ester of Example 7 Wt % Ester of Example 5 Viscosity at 40°C (cSt) 80 20 351. 7 60 40 377. 0 40 60 403. 0 EXAMPLE 12 ESTER BLEND The ester from Example 8 (40% by weight) and the ester from Example 5 (60% by weight) were combined to give a final product with a viscosity at 40°C of 399 cSt, a viscosity at 100°C of 37.2 cSt, a viscosity index of 138, an acid value of 1.3, a Gardner color of 13, a flash point of 580°F, a fire point of 670°F and a pour point of -33°C.

EXAMPLE 13 A blend was prepared from the ester of Example 8 (80% by weight) and the ester of Example 5 (20% by weight). The final product had a viscosity at 40°C of 349 cSt, a viscosity at 100°C of 34.5 cSt, a viscosity index of 142, an acid value of 1.7, a Gardner color of 13, a flash point of 580°F, a fire point of 675°F, and a pour point of -33°C.

EXAMPLE 14 ESTER-POLYPROPYLENE COMPATIBILITY The compatibility of ester blends of the present invention with polypropylene was determined by measuring the extent to which ester absorbed into polypropylene when the two materials were maintained in contact for several weeks. More specifically, samples of polypropylene extruded strips having dimensions 0.7 mm thickness and 20 mm width were weighed (each strip weight approximately 3 grams). A known weight of esters, in the range of 30 grams, was added to an aluminum pan of dimensions 63.5 mm x 17.5 mm. An individual strip of polypropylene was placed in the aluminum pan with the esters, and the pan was covered with aluminum foil.

The sample was maintained at 80°C for a predetermined period. First Ester Second Ester % Wt Gain % Wt Gain % Wt Gain Wk 1 Wk 2 Wk 4 80% Example 7 20% Example 5 4.95 5.06 4.93 60% Example 7 40% Example 5 4.23 4.88 4.88 40% Example 7 60% Example 5 4.56 5.09 4.90 For comparison, when the same procedure was followed using poly-alpha olefins instead of esters, the % Wt Gain values were 4.59 (1 week), 5.43 (2 weeks) and 5.94 (4 weeks).

All publications and patent applications mentioned in this specification are herein incorporated by reference to the same extent as if each individual publication or patent application was specifically and individually incorporated by reference.

From the foregoing it will be appreciated that, although specific embodiments of the invention have been described herein for purposes of illustration, various modifications may be made without deviating from the spirit and scope of the invention. Accordingly, the invention is not limited except as by the appended claims.



**(WO/2002/088208) POLYBASIC ACID ESTERS AND THEIR USE IN CABLES**[Biblio. Data](#) [Description](#) [Claims](#) [National Phase](#) [Notices](#) [Documents](#)

CLAIMS 1. A composition comprising a blend of first and second esters, the first ester comprising a reaction product of first reactants comprising trimer acid or reactive equivalent thereof, first polyhydric alcohol or reactive equivalent thereof, and first monohydric alcohol or reactive equivalent thereof; the first monohydric alcohol being selected from the group of C8-18 monohydric alcohols or reactive equivalents thereof; the second ester comprising a reaction product of second reactants comprising trimer acid or reactive equivalent thereof, second polyhydric alcohol or reactive equivalent thereof, and second monohydric alcohol or reactive equivalent thereof; the second monohydric alcohol being selected from the group of C6-10 monohydric alcohols or reactive equivalents thereof; the first and second monohydric alcohols being non-identical.

2. The composition of claim 1 wherein the first reactants and the second reactants each further comprise dimer acid.

3. The composition of claim 2 wherein the first reactants and the second reactants each comprise dimer acid and trimer acid, in a dimer acid: trimer acid weight ratio of 20: 80 to 80: 20, the weight ratio independently selected in each of the first and second reactants.

4. The composition of any of claims 1-3 wherein the trimer acid is hydrogenated trimer acid.

5. The composition of any of claims 1-4 wherein the first monohydric alcohol is selected from C10-14 primary monohydric alcohols.

6. The composition of any of claims 1-5 wherein the first monohydric alcohol is iso-tridecyl alcohol.

7. The composition of any of claims 1-6 wherein the first and second polyhydric alcohols are each selected from C3-15 polyhydric alcohols.

8. The composition of any of claims 1-6 wherein the first and second polyhydric alcohols are each independently selected from pentaerythritol, di-pentaerythritol, tri-pentaerythritol, trimethylolpropane, ethylene glycol and neopentylglycol.

9. The composition of any of claims 1-6 wherein the first and second polyhydric alcohols are each neopentyl glycol.

10. The composition of any of claims 1-6 wherein the second monohydric alcohol is selected from 2-ethylhexanol, 2-octanol and cyclohexyl alcohol.

11. The composition of any of claims 1-6 wherein the second monohydric alcohol is 2-ethylhexanol.

12. The composition of any of claims 1-11 wherein the first ester has a greater viscosity than the second ester.

13. The composition of any of claims 1-12 having a viscosity of 30-50 cSt at 100°C.

14. The composition of any of claims 1-13 having a viscosity of about 40 cSt at 100°C.

15. The composition of claim 1 wherein the first monohydric alcohol is selected from the group of C10-15 primary monohydric alcohols; the second monohydric alcohol is selected from the group consisting of C8 monohydric alcohols; the first and second polyhydric alcohols are selected from C3-15 polyhydric alcohols, and the viscosity of the composition is in the range of 30-50 cSt at 100°C.

16. A method for preparing an ester composition having a viscosity in the range of 30-50 cSt at 100°C. the method comprising the steps of: a) preparing a first ester, the first ester comprising a reaction product of first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol ; the first monohydric alcohol selected from the group of C₆- 18 monohydric alcohols ; b) preparing a second ester, the second ester comprising a reaction product of second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol ; the second monohydric alcohol selected from the group of C₆-10 monohydric alcohols ; and c) blending the first and second esters together in a proportion to provide an ester composition having a viscosity in the range of 30- 50 cSt at 100°C ; with the proviso that the first and second monohydric alcohols are non-identical.

17. The method of claim 16 wherein the first reactants and the second reactants each further comprise dimer acid, in a dimer acid: trimer acid weight ratio of 20: 80 to 80: 20, the weight ratio independently selected in each of the first and second reactants.

18. The method of any of claims 16-17 wherein the trimer acid is hydrogenated trimer acid.

19. The method of any of claims 16-18 wherein the first monohydric alcohol is selected from C₁₀-14 primary monohydric alcohols.

20. The method of any of claims 16-19 wherein the first and second polyhydric alcohols are each selected from C₃-15 polyhydric alcohols.

21. The method of any of claims 16-20 wherein the second monohydric alcohol is selected from 2-ethylhexanol, 2-octanol and cyclohexyl alcohol.

22. The method of any of claims 16-21 wherein the first ester has a greater viscosity than the second ester.

23. The method of claim 16 wherein the first monohydric alcohol is selected from the group of C₁₀-15 primary monohydric alcohols ; the second monohydric alcohol is selected from the group consisting of C₈ monohydric alcohols ; the first and second polyhydric alcohols are selected from C₃-15 polyhydric alcohols ; and the first ester has a greater viscosity than the second ester.

24. A composition prepared by the method of any of claims 16- 23.

25. A cable-filling composition comprising silica and a blend of first and second esters, the first ester comprising a reaction product of first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol ; the first monohydric alcohol selected from the group of C₈-18 monohydric alcohols ; the second ester comprising a reaction product of second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol ; the second monohydric alcohol selected from the group of C₆-10 monohydric alcohols ; the first and second monohydric alcohols being non-identical.

26. The composition of claim 25 wherein the first monohydric alcohol is selected from the group of C₁₀-15 primary monohydric alcohols ; the second monohydric alcohol is selected from the group consisting of C₈ monohydric alcohols ; the first and second polyhydric alcohols are selected from C₃-15 polyhydric alcohols, and the viscosity of the blend is in the range of 30-50 cSt at 100°C.

27. A method for insulating the contents of a cable, the method comprising a) preparing a cable-filling composition comprising silica and a blend of first and second esters; the first ester comprising a reaction product of first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol ; the first monohydric alcohol selected from the group of C₈- 18 monohydric alcohols ; the second ester comprising a reaction product of second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol ; the second monohydric alcohol selected from the group of C₆-10 monohydric alcohols ; the first and second monohydric alcohols being non- identical ; b) placing the cable-filling composition of step a) into a fiber optic cable.

28. The method of claim 27 wherein the cable is a fiber optic cable.

29. A cable comprising a cable-filling composition; the cable- filling composition comprising silica and a blend of first and second esters; the first ester comprising a reaction product of first reactants comprising trimer acid, first polyhydric alcohol and first monohydric alcohol ; the first monohydric alcohol selected from the group of C₈-18 monohydric alcohols ; the second ester comprising a reaction product of second reactants comprising trimer acid, second polyhydric alcohol and second monohydric alcohol ; the second monohydric alcohol selected from the group of C₆-10 monohydric alcohols ; wherein the first and second monohydric alcohols are non-identical.

30. The cable of claim 29 wherein the cable is a fiber optic cable.

Exhibit D

A copy of the Federal Express tracking confirmation for the April 27, 2007 letter from J.M. Gilbreth to Nancy Mosby.

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Exhibit E

A copy of the Federal Express tracking confirmation for the May 7, 2007 letter from J.M. Gilbreth to Nancy Mosby.



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	8:03 AM	On FedEx vehicle for delivery	HOUSTON, TX
	7:01 AM	At local FedEx facility	HOUSTON, TX
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Exhibit F

A copy of the May 8, 2007 letter from Nancy Mosby to J.M. Gilbreth.

May 6, 2007

Mr. J. M. (Mark) Gilbreth
Frost Bank Building
6750 West Loop South
Suite 920
Bellaire, Texas 77401

RE: ARZ - 024630-N1 (Application No. 11/637,206, PCT/US02/12961) Polybasic
Acid Esters and Their Use in Cables

Dear Sir:

Thank you for your letter dated April 27, 2007. In response please see the enclosed letter dated April 23, 2002 that expresses my continued wishes to have nothing to do with the above referenced patent, Arizona Chemical, or anyone associated with Arizona Chemical. Please note that the original was mailed directly to my former supervisor Lloyd Nelson who was employed by Arizona Chemical at the time.

To me, the previous letter is crystal clear. I do not understand why this matter was not resolved years ago and consider it to be so now. Any further contact or attempt to contact me by you or anyone associated with Arizona Chemical or their designees will be looked upon as harassment and will be handled as such.

Thank you,

Nancy

April 23, 2002

P.O. Box 2553
Savannah, Georgia 31402

To Whom It May Concern:

I, Nancy D. Mosby, hereby withdraw my name from everything connected with a patent being applied for by International Paper concerning an ISO VG 400 product (trimerate) developed by Lloyd Nelson and myself. Although one of my contributions (blending two different products (that I also helped develop) to achieve the desired viscosity of 400 cSt at 40°C) led directly to the development of the product being patented, I do not desire any credit or recognition in relation to this patent, nor do I desire to retain any potential benefits now or in the future associated with this patent.

Thank you for complying with my request. If you must contact me for anything further, you can direct a letter to the address listed above. I expect nothing less than common courtesy from you, and request nothing more.

Sincerely,

A handwritten signature in cursive script, appearing to read "Nancy D. Mosby".

Nancy D. Mosby

HOLISTON TX 772

07 MAY 2007 PM 2 L



Mr. J. M. (Mark) Gilbreth
Frost Bank Building
6750 West Loop South
Suite 920
Bellaire, Texas 77401

77401+4117

